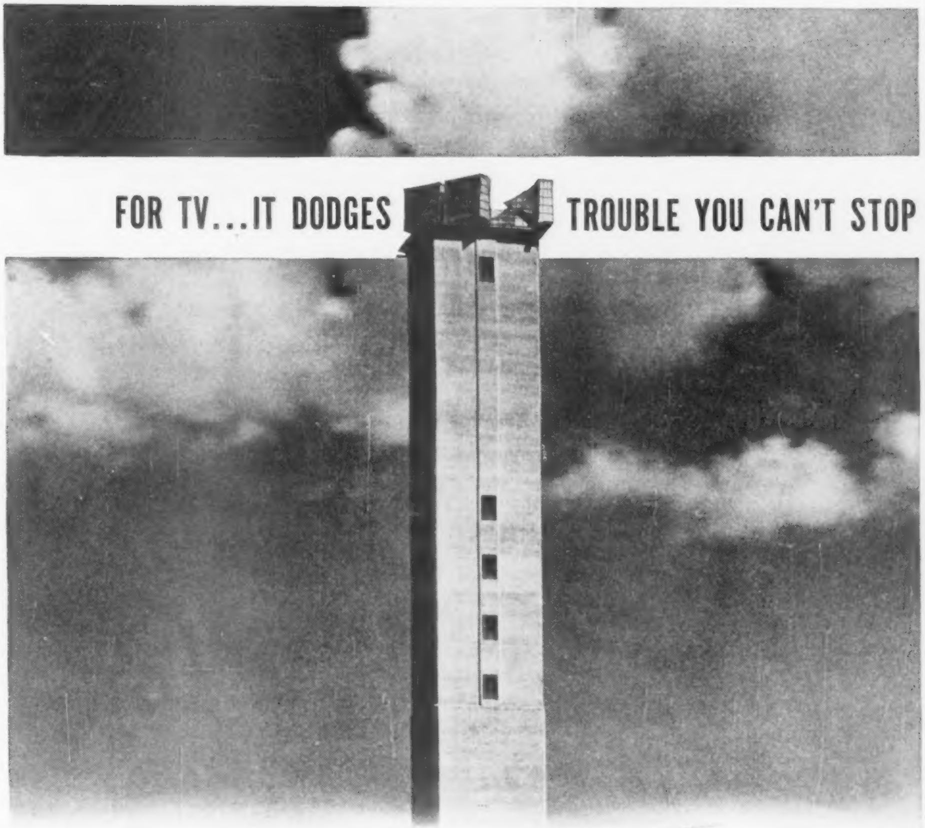
PHYSICS TODAY

VOL 8 NO 1 JANUARY 1955

YUKAWA HALL See page 14



FOR TV...IT DODGES TROUBLE YOU CAN'T STOP

Radio Relay station on route between Chicago, Ill., and Des Moines, Iowa. Every fifth or sixth relaying tower is a control station, where high-speed switching equipment enables a TV picture to skip out of a troubled channel and into a stand-by protection channel faster than the eye can wink.

There's no way to stop atmospheric changes that threaten television with "fade." But, for TV that travels over Bell's Radio Relay System, Bell Laboratories engineers have devised a way to sidestep Nature's interference.

When a fade threatens—usually before the viewer is aware—an electronic watchman sends a warning signal back by wire to a control station perhaps 200 miles away. An automatic switching mechanism promptly transfers the picture to a clear channel. The entire operation takes 1/500 of a second. When the fade ends, the picture is switched back to the original channel.

This is an important addition to the automatic alarm and maintenance system that guards Bell's Long Distance network for television and telephone calls. It marks a new advance in Bell Telephone Laboratories' microwave art, developed to make your Long Distance telephone service, and your TV pictures, better each year.

BELL TELEPHONE LABORATORIES

Improving telephone service for America provides careers for creative men in scientific and technical fields.

PHYSICS TODAY

Vol 8 No 1 January 1955

Published by the AMERICAN INSTITUTE OF PHYSICS, 57 East 55th Street, New York 22, N.Y.

in this issue . . .

THE AMERICAN INSTITUTE OF PHYSICS was founded in 1931 as a federation of leading societies in the field of Physics. It combines into one operating agency those functions on behalf of physics which can best be done by the Societies jointly. Its purpose is the advancement and diffusion of the knowledge of physics and its applications to human welfare. To this end it publishes for itself or the Societies nine journals; promotes unity and effectiveness of effort among all who are interested in physics; renders numerous direct services to physicists and to the public; and cooperates with government agencies, national associations, educational institutions, technical industries, and others in such manner as to realize the opportunities and fulfill the responsibilities of physics as an important and constructive human activity.

Physics Today is published monthly by the American Institute of Physics, Inc., at the Lancaster Press, Inc., Lancaster, Pa., U. S. A. Editorial, Circulation, and Advertising Offices are at 57 E. 55th St., New York 22, N. Y. Subscriptions—U. S. A. & Possessions, Canada, & Mexico: $4.00 per year (elsewhere: $5.00).

News and views

Federal Funds for Science

GOVERNMENT agencies have allocated about ten percent less for scientific research and development during the present fiscal year than in 1954, but a breakdown of the figures for 1955 indicates that basic research obligations have at the same time been increased almost ten percent over last year. The major decreases, according to estimates contained in the National Science Foundation's third report on federal funds for science, have occurred in obligations for research and development plant and facilities ($158 million in 1955 as compared with $227 million in 1954) and applied research and development ($1669 million in 1955 as compared with $1703 million in 1954).

The physical sciences account for some 87 percent of this year's obligations for research and development, of which $1.46 billion is for work in applied fields and $94 million for basic research. The corresponding figures for last year were $1.51 billion and $87 million, respectively. Research and development for national security account for about 85 percent of the 1955 science expenditures, with the remaining 15 percent distributed among other functions of government, including agriculture, health, welfare, transportation, communications, and development of natural resources. More than twenty federal agencies reported on their expenditures and obligations for science. Seven agencies accounted for more than 98 percent of the total funds. The Department of Defense was responsible for about 75 percent of the total; the other six agencies were the Atomic Energy Commission, the National Advisory Committee for Aeronautics, the Departments of Agriculture, Interior, and Commerce, and the Department of Health, Education, and Welfare.

Federal Obligations and Expenditures for Research and Development (in millions of dollars)

Fiscal Year	Obligations	Expenditures
1948	877	865
1949	1122	1097
1950	1244	1143
1951	1852	1342
1952	2217	1839
1953	2167	2119
1954*	2225	2133
1955*	1993	2020

* Estimated
Sources: Bureau of the Budget and National Science Foundation

Of the agencies reporting, only two, NSF and the Smithsonian Institution, use their total research funds for basic investigations.

Copies of the current NSF report (*Federal Funds for Science, III. The Federal Research and Development Budget, Fiscal Years 1953, 1954, and 1955*) may be obtained from the Superintendent of Documents, Washington, D. C. at a cost of 30 cents.

Atoms for Peace Proposal

UNANIMOUS approval of the resolution calling for the creation of an international agency for the peaceful use of atomic energy has been voted by the United Nations Political Committee (November 23rd) and by the General Assembly (December 4th). Despite the defeat of Soviet-sponsored amendments calling for Communist Chinese participation in next summer's international scientific conference and for placing the atomic agency under control of the Security Council, all of the Soviet-bloc nations voted to approve the resolution as a whole. United States delegate Henry Cabot Lodge has told the UN that this country will make available to the agency 100 kilograms of fissionable reactor fuel, will provide complete technical libraries of unclassified atomic energy data to nations belonging to the agency, and will make it possible for foreign students and research scientists to study and work in selected training schools and research establishments in the United States.

Atomic Energy Commissioner Lewis L. Strauss, speaking before an Executives Club luncheon in Chicago on December 3rd, announced that Argonne National Laboratory's CP-5 research reactor "has been in the main declassified and pertinent information concerning its construction and operation will be available". Noting that the 100 kilograms of fissionable material earmarked by the United States for use by the international agency would be sufficient to provide the critical inventory for fifteen such reactors for five years of operation and still have most of the fuel unconsumed, Admiral Strauss said, "These fifteen reactors would multiply many times the research reactor capabilities of the free world, excluding the United States. Each of them could produce more radioisotopes of varied types than are presently needed by Holland or Switzerland or Belgium or, for that matter, any country in the world."

Protection of Unclassified Secrets

AN Office of Strategic Information has been created in the Department of Commerce in order to "provide a central location within the government which will work with the business community in voluntary efforts to prevent unclassified strategic data from being made available to those foreign nations which might use such data in a manner harmful to the defense interests of the United States". According to an announcement made on November 5th by Secretary of Commerce Sinclair Weeks, the office was established at the direction of the President on the recommendation of the National Security Council.

"In this cooperative effort at self-protection," Mr. Weeks said, "we will undertake to revitalize the voluntary system of carefully evaluating the export of scientific, engineering, and other information of a nonstatistical nature which, while unclassified, might nonetheless be prejudicial to our national security if it fell into unfriendly hands. Such watchfulness would not take the form of censorship. It would instead be a matter of exercising intelligent, reasonable precaution to make sure that in the necessarily free exchange of scientific information we do not provide nations whose interests are inimical to our own with material which they could some day use against us. The key to success of this program lies in the cooperation of all who develop and disseminate our national knowhow."

The Secretary has appointed R. Karl Honaman as special consultant and director of the new office. Mr. Honaman, an electrical engineer, is on loan from the Bell Telephone Laboratories in New York City, where he is director of publication. He will work with a committee of Commerce Department information, security, and administrative officials in carrying out the functions of the office.

Criticism of the Administration's action in establishing the Office of Strategic Information was promptly offered by the American Society of Newspaper Editors in the form of a report filed by the Society's Freedom of Information Committee. Terming the move "the most serious threat to freedom of information that has developed in the Eisenhower Administration," the committee said that, regardless of the voluntary devices employed, "a proposal under which the government is going to 'help' the American press decide what nonclassified information it ought to print and what it ought not to print is a species of censorship of the most offensive and dangerous kind."

NAS-NRC Activities, 1953-54

HIGHLIGHTS of the varied undertakings of the National Academy of Sciences and National Research Council for the period July 1953 to June 1954 have been summarized by S. D. Cornell, NAS-NRC executive officer, in the bimonthly publication *News Report*. During the year some four hundred meetings were held, several thousand fellowship and research grant applications were evaluated under programs in which the Academy-Research Council plays a part, about fifty NAS-NRC scientific and technical publications were printed, and a large number of permanent and ad hoc committees and other groups conducted special studies and prepared advice on scientific matters for government agencies and private organizations. These and other activities were carried out during the one-year period with a total expenditure of approximately $5.5 million, of which somewhat more than thirty percent came from private grants, contracts, and endowment income, while the remainder came from federal government sources. In addition, Dr. Cornell notes, the expenditure by other agencies of more than $2 million of private funds and more than $6 million of government funds in the support of science through fellowships, grants-in-aid of research, and by basic research contracts was directly guided by advice rendered by NAS-NRC.

AIP Advisory Committee to NBS

THE National Bureau of Standards faced a crisis in the spring of 1953 as a result of a controversy over the Bureau's position on certain types of battery additives. At the height of the tense situation, Secretary Weeks decided to attempt to resolve the controversy by seeking the advice of an Ad Hoc Committee composed of representatives of the professional scientific and engineering societies. L. A. DuBridge was appointed the American Institute of Physics representative of this group, which popularly came to be called the Kelly Committee since M. J. Kelly of the Bell Telephone Laboratories was its chairman. The committee was singularly effective in resolving the crisis through a series of actions and through recommendations contained in its final report of October 15, 1953. For example, its work in no small measure led to the reinstatement of A. V. Astin as Director of the Bureau.

Among other things, the Kelly Committee advised that the Bureau focus most of its attention on the activities of primary Bureau interest and serve appreciably less as an organization which operates installations for other governmental agencies through use of transferred funds.

The legislation establishing the Bureau of Standards provides that the Secretary of Commerce have a five man Visiting Committee to furnish him with advice on the activities of the Bureau. The Kelly Committee recommended that the advisory system be augmented by the formation of a set of Technical Advisory Committees whose members would be selected by the eight leading professional societies and which would report to the Director of the Bureau in order to advise both him and his staff on matters which the committees and staff consider worthwhile. This plan was accepted enthusiastically by Secretary Weeks and the Bureau staff and has now been placed in operation.

Since many of the most important activities of the Bureau lie in the various fields of physics, it is evident that the committee appointed by the AIP will play a central role in the new advisory structure. This group consists of J. W. Beams, D. M. Dennison, E. M. Purcell, J. A. Bearden, M. Deutsch, R. B. Lindsay, F. Seitz (Chairman), Hale Sabine, and R. A. Sawyer. L. D. Marinelli of the Radiological Physics Division of Argonne National Laboratory is also serving with the committee by invitation. Three of the nine men appointed by the AIP will be replaced each year so that each man will serve for three years.

The AIP committee held an organizational meeting on May 1, 1954, at the Bureau. In cooperation with the Bureau staff, it decided that it should devote most of its attention to three of the Bureau's 14 Divisions, namely Divisions 2, 3, and 4 which are concerned with Optics and Metrology, Heat and Power (including cryogenics) and Atomic and Radiation Physics. As a result the group divided into three panels, each of which will give particular attention to one of the Divisions.

The Committee chairmen met on August 15 to discuss intercommittee relations and agreed that it would be highly desirable to have members of one committee serve with the panels of another in cases in which individual interests evidently would make this profitable. For example, Mr. Sabine of the American Acoustical Society can serve very effectively on the panel of Division 6, devoted to Mechanics.

The Physics Committee held its first full-fledged meeting on November 13, at the Bureau. The morning session was spent with Dr. Astin, two of the Associate Directors, Drs. Brode and Huntoon, and six of the Division Chiefs, Drs. Alt, Brickwedde, Gardner, Ramberg, Silsbee and Taylor, in a detailed discussion of the Bureau's organization and operating problems. During the afternoon each of the three panels met with the heads of the Sections of the Divisions for which the panels have primary responsibility and discussed a wide variety of matters covering such topics as research programs, budget limitations, acquisition of new personnel, divisional meeting, and interdivisional cooperation.

It is felt that the Advisory Committee will aid the Bureau in many ways. Not only are the members experts in various fields of fundamental and applied physics, but many have first-hand experience in the problems of organizing, operating, and financing laboratories which can be added to the broad experience of the Bureau's excellent staff. Still further, the Committees provide a direct link between the typical Bureau scientist and engineer and his colleagues having parallel interest in other parts of the country. While membership in professional societies furnishes some of this, the committee pattern provides a far more intimate relationship.

It has already become evident to the AIP committee that the Bureau is operating under much too restricted a budget. This fact is clearly recognized by the Department of Commerce which authorized the Bureau last year to request from the Congress an increase in its budget of about 30 percent. Although only a fraction of the increase was allowed, the Department is actively supporting an even larger request for next year.

It is also evident to the Committee that the operations of the Bureau are greatly impeded by the fact that none of the funds allotted to it directly by the Congress have longevity beyond June 30 of the fiscal year in which the money is voted. This means, for example, that the Bureau is seriously restricted in employing new graduates of universities. It cannot make commitments in the spring, when most graduates seek jobs, for the following summer or fall, since the new positions cannot be guaranteed until the new budget is passed after July 1. This disadvantage and others related to it would be remedied if a fraction of the budget of the Bureau were given a lifetime beyond one year. It is important to note that this principle is now clearly recognized by the government in contracting for research and development. Most of the funds allocated directly to organizations such as the Office of Naval Research and the Office of Scientific Research of ARDC have a longevity of three years, once they have been contracted.

The financial problems of the Bureau represent, of course, only one facet of the important complex being considered by the Committees, although they are among the most obviously pressing ones at the moment. Viewed in the whole, the National Bureau of Standards is an essential national agency which has no counterpart in our country and which provides a unique service to our scientific and technical life. Any help and advice which the professional groups can give to make certain that it is rendering its service in the most effective and efficient manner can only act to strengthen our material fabric.

F. Seitz

Applied Mathematics Committee

ANOTHER part of the advisory committee organization mentioned above, the Technical Advisory Committee for the Applied Mathematics Division of NBS, is nominated by the Policy Committee of the Mathematical Societies of America, which was one of the eight organizations represented on the original Kelly Committee.

Although the advisory group primarily represents mathematicians, parts of the Applied Mathematics Division's work are of considerable interest in terms of physics and the Policy Committee consequently nominated two physicists, Philip M. Morse of Massachusetts Institute of Technology and Edward Teller of the University of California, to sit as members of the Advisory Committee. The other members are David Blackwell of Howard University, Mark Kac of Cornell University, Mina S. Rees of Hunter College, and A. H. Taub of the University of Illinois.

The latest meeting of the Committee was on October 23rd, at which time the work load of the Division was considered and the needs for new computing equipment were discussed. The Division deals with the computing and statistical problems of the Bureau and other governmental agencies and to some extent of research elsewhere in the country. It has four sections: a numerical analysis section; a statistical engineering laboratory; a mathematical physics section; and a computation laboratory, which puts out the NBS Mathematical Tables and programs and schedules the Bureau's high-speed computing machine, the SEAC.

Born and educated in Italy, Enrico Fermi came to this country in 1938 instead of returning to Italy from Stockholm, where he had just received the Nobel Prize. Shortly before his death he was named by the AEC to receive a special $25,000 award for his outstanding contributions to the atomic energy program.

ENRICO FERMI

1901 - 1954

The untimely death of Enrico Fermi on November 28th deprived the world of one of its most brilliant and productive physicists. The following remarks by three of Fermi's friends and colleagues were made on the occasion of a memorial service held on December 3rd in the University of Chicago's Rockefeller Memorial Chapel. Samuel K. Allison, professor of physics and director of the University's Institute for Nuclear Studies, presided at the ceremony.

A Tribute to Enrico Fermi by S. K. Allison

WE are here to honor the memory of Enrico Fermi, Charles H. Swift Distinguished Service Professor of Physics at this University during the last decade. I shall try to express the sentiments of his associates here in the Institute for Nuclear Studies. Actually, the Institute is *his* Institute, for he was its outstanding source of intellectual stimulation. It was Enrico who attended every seminar and with incredible brilliance critically assayed every new idea or discovery. It was Enrico who arrived first in the morning and left last at night, filling each day with his outpouring of mental and physical energy. It was Enrico's presence and calm judgment, and the enormous respect we had for him, which made it impossible to magnify, or even mention, any small differences among us, such as can arise in any closely associated group. It was at Enrico's personal and urgent request that I took on the chore of directing the Institute in its routine affairs.

It is a completely objective statement, not at all prompted by the emotion of this occasion, to remark that every one who had more than a trivial acquaintance with Mr. Fermi recognized at once that here was a man who possessed a most extraordinary endowment of the highest human capabilities. We may have seen his physical energy before, or his basic balance, simplicity, and sincerity in life before, or even possibly his mental brilliance, but who in his lifetime has ever seen such qualities combined in one individual?

In my attempts to understand him, with his completely successful adjustment to the life of today, and his leadership in it, I conclude that one reason such men are so rare is that it is so improbable that such a combination should be formed.

I would like to recount one incident showing Enrico in action. During the war, Professor A. H. Compton, Enrico Fermi, and I were travelling together to visit the Hanford Plutonium Plant in the State of Washington. Mr. Compton and Mr. Fermi were so valuable that they were not allowed to travel by air; I was expendible, and could have flown, but was on the train with them for company. The hours seemed to drag crossing the mountains, and Enrico, who always disliked travelling, was restless and bored. After some long silences, Mr. Compton said:

"Enrico, when I was in the Andes mountains on my cosmic-ray trips, I noticed that at very high altitudes my watch didn't keep good time. I thought about this considerably and finally came to an explanation which satisfied me. Let's hear you discourse on this subject."

Enrico's eyes flashed. A problem! A challenge! Something to work on! Having been in several such situations before, I relaxed and prepared to enjoy the fireworks that would surely follow. He found a scrap of paper and took from his pocket the small slide rule he always carried. During the next five minutes he wrote down the mathematical equations for the entrainment of air in the balance wheel of the watch, the effect on the period of the wheel, and the change in this effect at the low pressures of high altitudes. He came out with a figure which checked accurately with Mr. Compton's memory of the deficiencies of his timepiece in the Andes. Mr. Compton acknowledged the correctness of the calculation, and I shall not forget the expression of wonder on his face.

It is with such a man that we in the Institute could consult daily, and it is such a man that we have lost.

Let us pause a moment and ask ourselves why a man of this calibre abandoned a comfortable professorship and great honors in his own country to join us and become a citizen of the United States. Many other intellectuals of the highest type have done likewise. There is really only one reason, namely, that the limitations placed on the range and freedom of activity of the mind had become intolerable in the countries which they left. They could not tolerate politicians proclaiming and acting upon pseudo-racial doctrines that could not for a moment stand the light of rational analysis. They could not tolerate a climate in which responsible and vigorous criticism of political actions was rewarded with defamation of character and possibly with imprisonment and death. Let us be sure that our freedoms here in these respects remain unimpaired. As long as men like Enrico Fermi turn to us and join us, though hosts be against us, we shall prevail.

THE speakers on our program have been chosen because of long and intimate association with Mr. Fermi. Professor Emilio Segrè, who will speak first, was the recipient of the first Doctor of Philosophy degree awarded under Fermi's sponsorship at the University of Rome. He was one of the group who associated there with Mr. Fermi in his classic researches on the properties of slow neutrons. Professor Segrè comes from the Department of Physics of the University of California for this occasion.

The final speaker will be Professor H. L. Anderson, who is a member of the staff of our Institute for Nuclear Studies. He was a student of Mr. Fermi's at Columbia University, and worked continuously and closely with him during the great effort of the war years, which led to the controlled release of nuclear energy from uranium, twelve years ago yesterday, here on our campus.

A Tribute to Enrico Fermi by Emilio Segrè

WE are here to commemorate and honor one of the greatest scientists of the century and it is appropriate that the highlights of his achievements, some of which seem likely to become of transcendental importance for mankind, be properly mentioned. But the choice of speakers, not from his peers in science, but from pupils and friends, seems to me to indicate a desire to have his human traits remembered also.

However, for Enrico Fermi physics was almost synonymous with life, and the man and the scientist are one. Any effort to separate them would be futile and irreverent.

He was born in Rome on September 29, 1901, and hence his much too brief life spanned only 53 years. He studied at Rome, and at Pisa at the Scuola Normale, an institution stemming from Napoleonic times which gave many illustrious scientists to Italy.

He obtained his Doctor's degree in 1922 with a thesis on X-rays. However, he was essentially self-taught, or better, his real spiritual teachers were a strange assortment of books ranging from a natural philosophy of the Jesuit Father Caraffa, written in 1840, the *Mécanique Rationelle* of Poisson, to Kelvin and Tait, Richardson's *Theory of Electrons*, and, above all, Sommerfeld's *Atombau* for the more modern subjects. These he read between the end of childhood and the end of adolescence.

His first published works are concerned with relativity, mechanics, and electrodynamics. We see him trying his forces on several interesting subjects, but soon he moves to deep reflections on thermodynamics and statistical mechanics. Thus, he was all prepared to discover in 1926, immediately after the formulation of the exclusion principle by Pauli, the statistical laws followed by the antisymmetrical particles now called fermions.

This work brought him at once to a pre-eminent place among theoretical physicists, and it was promptly followed by numerous other studies in atomic physics. In all of his work of the time we find his personal scientific style already fully developed. Really brilliant ideas are developed with such apparent simplicity of theoretical means that the results seem to flow without effort. The theory of the Raman effect, of the hyperfine structure, of the intensity of the alkali doublets, of the pressure shift of spectral lines, of the latitude effect in cosmic rays, the concept of the virtual quanta accompanying a moving charge, the statistical atom and many more, bear testimony to the universality of his interests and to the power of his genius. He initiated many a line of thought which was to be pursued by a whole generation—and the mine is not yet fully exploited.

I first met Fermi at this time and I remember the experience shared later by others of beginning a conversation with him, which ended by his taking a piece of chalk and improvising on a blackboard a theory that needed only to be written up and published. The last time that I saw this was, alas, on February 11th of this year when I was telling him about some nuclear experiments in which I was involved.

In 1927 the school of Rome was also founded and I beg to be excused if I am too personal in my remem-

Laura and Enrico Fermi in the latter's study at the Institute for Nuclear Studies at the University of Chicago. A warmly human panorama of Fermi's life is to be found in *Atoms in the Family*, a biography written by Mrs. Fermi and published last October by the University of Chicago Press.

brances. Fermi's exceptional ability had been recognized, not without some struggle, by a professorship at Rome, a coveted position and quite exceptional for a man of only 26 years. However, he decided then that he needed some help, and some co-workers, and in very characteristic fashion proceeded to create them. He selected a small nucleus of young men, by his own criteria, and trained them in his own unorthodox way. I do not think he ever spoke of scientific ideals or that he used any moralizing words, but by force of example inspired in everybody such a burning devotion to science that I venture to say that for this group of young men between ages 20 and 25, with a leader of 27 or 28, science was the greatest passion, none excluded. And the Fermi influence of their scientific outlook was indelibly impressed and persisted even after they lost Fermi's mannerisms of speech and deep voice which they had unwittingly acquired in their daily common life.

In the early 30's more theoretical work followed. A reformulation of Dirac's theory of radiation led Fermi in the abstract paths of second quantization from which his rather practical mind at first recoiled. But his feeling changed after he had developed in 1933 what he considered a "practical" application, namely the theory of beta decay, one of the milestones of theoretical nuclear physics. With this he began his career as a nuclear physicist.

However, 1934 was to be the wonder year in which, without abandoning theory, he entered professionally into the experimental field. Indeed he had always, even from his childhood, dabbled a little in experiment and some of his work with Rasetti is quite first class, but the plan he had nurtured for some time of attacking experimentally some important problem concerning the nucleus materialized when news came of Curie-Joliot's discovery of artificial radioactivity. Fermi realized at once that neutrons would be more powerful projectiles than charged particles and tried them immediately; it is characteristic of the man that he tried in order all available elements beginning with hydrogen, and did not give up when the first eight were unsuccessful. The ninth, fluorine, finally gave a positive result. It was also characteristic that he summoned his young pupils and friends, mostly busy with their own problems, to come, help, work hard, and share the conquests with him.

A series of startling discoveries followed. The letters to the *Ricerca Scientifica*, sent to many nuclear scientists as what we would call today "preprints", elicited great interest, and Rome became, for a short period, the capital of the nuclear world. Lord Rutherford in person congratulated the young experimentalist for his debut. If I remember correctly, "Not bad for a beginner", were his own words in a congratulatory letter that he wrote at the time to Fermi.

In rapid succession all the elements, including uranium, were bombarded, but God, for his own inscrutable ends, made everybody blind to the phenomenon of fission. Chance confronted us with the strange phenomena undergone by neutrons in passing through hydrogenous substances; Fermi's mind grasped what was going on in a couple of hours. Thus, slow neutrons were discovered and these first steps, by a logical development, led him to study the diffusion of neutrons.

It was at this time more than at any other that I saw the full application of one of Fermi's outstanding human, or I would almost be tempted to say superhuman, characteristics, namely his unbelievable physical and mental strength. We were working quite methodically from 8 in the morning to 1, followed by lunch, siesta, and then again from 3 to 8 in the evening; but the intensity of the work was such that this practically represented the limit of our forces—and we were not weaklings.

However, every morning at 8, Fermi came back with some piece of theory concerning the neutron, ready to test it experimentally and to change it according to the results of the work of the day. This performance puzzled us a little, even knowing with whom we were dealing, but we soon discovered that the miracle occurred between 4 A.M. and 8 A.M. because he had insomnia and had decided to lengthen his day's work. I wanted to mention this because this strength and indomitable vitality was one of his fundamental characteristics.

By this time, intolerant persecution was rampant in Germany. We had had as visitors, guests, and friends, many brilliant young colleagues from central Europe, attracted to Rome by Fermi. Bethe, Bloch, Placzek, Peierls, London, and several others stayed with us for a few months, an ominous warning of impending catastrophe, and when in 1938, Italy also was submerged, Fermi departed as had many others, for the New World.

The aging Sommerfeld from Germany commented in a moving letter, "Sic transit gloria mundi veteris" (Thus passes the glory of the old world), and added, "To the greater glory of the New World."

In 1939, the Power which had initiated this tremendous chain of events opened the eyes of man to fission and Fermi, who had just arrived at Columbia, started a new group of young people, and, using his mastership of the neutron, embarked on that trip which was to land him, 12 years ago almost to the day, in that new world so properly indicated in the historic message announcing the criticality of the pile. One of his companions in this trip will tell you about it.

I cannot terminate this brief tribute without mentioning some things which I find I have omitted, because in writing with Fermi in mind they just did not occur to me: he had had all the honors that a scientist can have, none excluded. He was part of great councils, and for a large group of scientists his word was final. I have not mentioned these facts because for him they were really unimportant. Nothing altered his simplicity, which did not arise from false modesty—indeed he knew quite well how much he was intellectually above other men—but from charity. Nothing altered his unceasing interest in Science and his will to work humbly and indefatigably on the study of nature. If he had foreseen the cruel destiny that was to deprive us of him so unexpectedly early, he could not have husbanded his time to give more than he gave.

A Tribute to Enrico Fermi by H. L. Anderson

TODAY we are gathered here to pay our respects and to honor Enrico Fermi. He was our friend, our colleague, and our teacher, and he was a great man.

When he came to America 16 years ago, Enrico Fermi was already a celebrated scientist. He had a long list of scientific achievements. He had discovered new and fundamental laws of nature. The Fermi-Dirac statistics, his theory of the beta rays and his statistical atomic model stand out among many other great accomplishments. For his mastery of the neutron he had been awarded the Nobel prize and he stood at the pinnacle of his profession.

But now the Fascist mold had begun to infect the free and fruitful development of science in Italy. Fermi, with characteristic courage and decision, turned his back on his native land and set out to America to establish the American branch of his family. In America, Fermi could expect to find fertile ground for his ideas and a receptive climate for his genius. For the sanctuary which we gave him then, Fermi repaid us a thousandfold. We can be forever grateful that, when he came to us, our gates were open.

His needs were few. Chalk, a blackboard, and an eager student or two were enough for a start. Teaching was an essential part of his method. Through teaching he would sharpen his wits, clarify his thoughts, develop his ideas. Students and colleagues soon learned that no one could touch him when it came to clarity and brilliance of lectures. It was usually "Standing Room Only" when Fermi spoke—but he would lecture with equal brilliance to a lone student. And he would make a deal —if you would correct his English and teach him Americanisms—he would teach you physics.

The eternal scholar, Fermi was always eager to learn. He was always grateful when he found out something new. What he learned he felt he should enrich. Having enriched what he learned he felt he should teach it to others. Thus, he prepared the fertile ground out of which arose the new solutions and new ideas which kept his subject bright, fresh, and exciting.

At Columbia he had hardly settled his family when news of the discovery of the fission of uranium arrived. "Let me explain this business of the fission of uranium," he said. "The neutron enters and causes an instability in the uranium nucleus and it's split apart. A great deal of energy is released, as Otto Frisch has shown. But the circumstances are those in which, in all probability, neutrons will be emitted as well, and this is at the root of the matter. For if the neutrons are emitted in greater number than they are absorbed, a chain reaction will be possible and the way to a new source of energy will have been found. Come and help me find these neutrons. Let us measure their absorption and their emission with some care so that we can understand these processes in detail and know how to proceed."

To explore the mysteries of nature with Enrico Fermi was always a great adventure and a thrilling experience. He had a sure way of starting off in the right direction, of setting aside the irrelevancies, of seizing all the essentials and proceeding to the core of the matter. The whole process of wresting from nature her secrets was for Fermi an exciting sport which he entered into with supreme confidence and great zest.

No task was too menial if it sped him towards his goal. He thoroughly enjoyed the whole of the enterprise: the piling of the graphite bricks, the running with the short-lived activated rhodium foils, and the merry clicking of the Geiger counter which effected the measurement. All was done with great energy and obvious pleasure, but by the end of the day, in accordance with his plan, the results were neatly compiled, their significance assessed, and the progress measured, so that early in the morning on the following day, the next step could begin.

It was a feature of the Fermi approach never to waste time, to keep things as simple as possible, never to construct more elaborately or to measure with more care than was required by the task at hand. In such matters his judgment was unerring. In this way, step by step, the work sped forward until in less than four short years Fermi had reached his goal. A huge pile of graphite and uranium had arisen in the West Stands of the University of Chicago Campus. When, on December 2, 1942, 12 years ago just yesterday, Enrico Fermi stood before that silent monster he was its acknowledged master. Whatever he commanded it obeyed. When he called for it to come alive and pour forth its neutrons it responded with remarkable alacrity; and when at his command it quieted down again, it had become clear to all who watched that Fermi had indeed unlocked the door to the Atomic Age.

By now the Manhattan Project had grown enormously in size. The exigencies of war required it to produce atomic bombs and it assumed a character not at all in keeping with the Fermi style. Administrative and organizational responsibilities usually charged with controversy he avoided. But there were those who came to recognize that in scientific and technical matters the words of Fermi were golden. Such advice he gave generously and freely and so in unobtrusive ways he helped guide the whole enterprise to its successful conclusion.

There followed a period at Los Alamos where Fermi had been asked to go to participate more directly in the atomic bomb work. Here the work had been already well advanced by a group of distinguished scientists among whom were many former colleagues. They too, like himself, had found sanctuary in America from the oppressions of Europe. Here, in a remarkable cooperative effort, the atomic bomb was designed, made, and tested.

One unerasable picture of Fermi had to do with the fateful morning set aside to test the first atomic bomb. It showed Fermi standing in the blinding glare of that explosion, methodically dropping small bits of paper to the ground. Some of these were carried forward by the arrival of the blast. Impatient to know the strength of the atomic explosion, Fermi had devised his own simple means for measuring it.

What Fermi missed at Los Alamos was the University. This he regained at Chicago, whose faculty he joined at the end of the war. Here, in the Institute for Nuclear Studies, established essentially according to his own design, he was again free to explore nature according to his fancy. Students flocked to his classes while physics itself, flushed with its success on the field of battle, surged on in new directions.

New particles had been discovered and huge electronuclear machines had been constructed to produce them. Here, at Chicago, under his guidance, we built a huge synchrocyclotron. This became Enrico's newest plaything. This machine could produce the mesons which had come to occupy the center of the stage. These were the particles which were responsible for the nuclear force. A new great challenge for Enrico. What were the facts? What was their meaning?

Counters, liquid hydrogen, magnets, all the paraphernalia of modern physics were brought to bear with Enrico in the thick of it. It was in the midst of this work that from an unexpected quarter, Enrico Fermi was suddenly and unaccountably struck down.

We all know what a pleasure it was to have Enrico around; what a privilege it was to work with him. We all know how considerate and thoughtful he was; how helpful he could be. He was the center of our Institute around whom all revolved and for whom we all tried to do something good enough to win his praise. Well, he isn't going to be around any more. We're going to miss him awfully but we can all try to keep the spirit that he had.

YUKAWA HALL AND MODERN PHYSICS IN JAPAN

Experimental physics research in Japan was all but crushed by the war and its aftermath, but with much intensity of purpose and devotion to their science Japanese physicists have turned to theory and are creating one of the world's foremost centers of modern theoretical physics.

*By **M. Kobayasi***

THE AWARD of the 1949 Nobel Prize for physics to Dr. Hideki Yukawa, professor of Kyoto University, was a matter of considerable importance to Japan. This news was received with tremendous joy by the Japanese and encouraged the scientists in Japan to continue their researches in spite of the economic condition of postwar Japan.

Dr. R. Torikai, the president of Kyoto University, suggested to the government that it erect a building on the campus of Kyoto University in honor of Dr. Yukawa for his contribution to the development of human knowledge. Dr. Torikai's suggestion was further supported by the Science Council of Japan. The government agreed to the above proposal and the construction of a new building was begun in the Botanical Gardens of Kyoto University. The construction of such a building by the government was a very unusual event in postwar Japan. The building was completed in the early summer of 1952. This three-story, modern building was named Yukawa Hall. It contains, in addition to lecture halls and seminar rooms, a number of offices, a common room, and a fine library. It was further decided by the University and the government authorities to utilize this building for the purpose of the development of theoretical physics in Japan.

To show the need and importance of such an institute for the development of science in Japan of today, it will be appropriate to describe the state of modern physics in Japan in the past two decades.

M. Kobayasi, professor of physics at Kyoto University, was an early collaborator of Dr. Tomonaga and Dr. Yukawa. He is also closely associated with the activities of the Research Institute for Fundamental Physics at Kyoto, Japan. He is at present visiting the Institute for Advanced Study at Princeton, N. J.

Nobel Laureate Hideki Yukawa resigned from his post as professor of physics at Columbia University in 1953 to become the first director of the newly-established Research Institute for Fundamental Physics at Kyoto University.

Yukawa Hall at Kyoto University, home of Japan's Research Institute for Fundamental Physics

BEFORE the war, there were a number of pioneers in modern physics in Japan. The most prominent one among these earlier workers was Dr. Yoshio Nishina. He had in him the combined qualifications of a great teacher and an excellent researcher. The pre- and postwar researchers in theoretical and experimental physics in Japan are greatly indebted to him. After his graduation from Tokyo University he went to Europe, and during his long stay in Europe from 1921 to 1928, he worked with Lord Rutherford at Cavendish Laboratory and with Professor Niels Bohr at Copenhagen. He came back to Japan with considerable experience in modern physics, and was appointed as head of a new laboratory at the Institute of Physical and Chemical Research in Tokyo.

Many young scholars were attracted by his personality and enthusiasm, and thus he succeeded in establishing a new school in both theoretical and experimental physics. As for the research in theoretical physics, he was not only the chief of his laboratory, but also the nucleus of research scholars in his country. A group of research scholars in nuclear physics became organized throughout Japan with Dr. Nishina as their chief. This group held periodic symposia and discussions on the current topics in quantum field theory and nuclear physics, and also published a mimeographed circular in order to inform the workers about the latest developments in these fields.

Some of the researches of this group are worth mentioning. Dr. Yukawa, while working at Osaka University, discovered the Meson Theory as early as 1935. This theory was further developed by him and Dr. Syoiti Sakata, Dr. Mituo Taketani, and the writer. Dr. Sin-itiro Tomonaga, another member of this group, discovered the Covariant Field Theory in 1943. He also contributed to the Meson Theory by discovering the Intermediate Coupling Theory. Since his work was mainly done during the war, it could not be communicated to the foreign journals. Besides these important discoveries there were a number of other contributions to modern physics, which established the status of research in theoretical physics in Japan.

It will also be of interest to survey the state of research in experimental physics in Japan before the war. There were four cyclotrons in Japan: two of them were built up by Dr. Nishina at the Institute of Physical and Chemical Research and the other two by Dr. S. Kikuchi at Osaka University and by Dr. B. Arakatsu at Kyoto University. In addition to these cyclotrons, there was other equipment for nuclear research, such as electrostatic generators and some accelerators. Thus, before the war, research in experimental physics was also gaining more and more prominence in Japan. But during the war research in pure physics was slowed down, and at the end of the war, almost all the equipment in nuclear physics was destroyed or removed.

AT the end of the war, many scholars came back to their universities with the hope of continuing research in pure physics. Because of the poor economic condition of the country, it was difficult to rebuild equipment for experimental research and it seemed as if this field had to be temporarily abandoned. Research in theoretical physics was, however, a different matter. The scholars in this field were able to continue their work with pencil and paper. International communication in the research field was also renewed. Dr. Yukawa and Dr. Tomonaga were invited to the Institute for Advanced Study at Princeton. Several young scholars were also invited to this and other institutions in the United States and Europe. Thus, the achievements of research in the field of theoretical physics in Japan became more and more widely known. The award of the Nobel Prize to Dr. Yukawa gave a further stimulus to research in this field. Partly due to the unavailability of equipment for experimental research and partly due to the achievements in theoretical physics, most of the research in Japan is being carried out presently in theoretical fields.

There are, at this time, about two hundred research scholars in quantum field theory and nuclear physics. These fields of theoretical physics are called, as a whole, the Theory of Elementary Particles, or "Soryushiron" in Japanese. Research in this field is quite well organized. The workers have formed an association known as "The Research Group of the Theory of Elementary Particles". This association arranges symposia, discussions, and meetings, and also publishes the mimeographed circular *Soryushiron Kenkyu*.

Yoshio Nishina, who died early in 1951, has been termed the "father" of modern physics in Japan. As pre-war head of the physics laboratory at the Institute of Physical and Chemical Research in Tokyo, he was the teacher of many of Japan's rising physicists.

There is also growing another organization of the workers in the theoretical fields of atomic and molecular physics. In these fields, known in Japan as the Theory of Properties of Matter, or "Busseiron", there is about the same number of research scholars as in the field of elementary particle theory. This group also publishes the mimeographed circular *Busseiron Kenkyu*, and holds symposia and seminars on the current topics in these fields.

The above-mentioned groups are carrying out their researches under adverse living conditions. Because of the large number of scholars and the limited number of jobs, many of these scholars cannot get employment in universities. Even those who are employed by the universities must supplement their incomes by taking side jobs.

IN SPITE OF the economic condition of postwar Japan, Kyoto University and the Science Council of Japan were eager to make Yukawa Hall a national school of learning. Therefore, they agreed to establish in this Hall the Research Institute for Fundamental Physics, which, although managed by Kyoto University, is not exclusively meant for the members of Kyoto University. Both of the groups share in the administration and general policy formation, by sending their representatives to the Managing Committee of this Institute. Further, the subcommittees for the discussion of the research projects of this Institute are also elected by these groups.

After the establishment of the Institute, the Managing Committee requested Dr. Yukawa to become its first director. Dr. Yukawa, who was at that time a professor at Columbia University, accepted this invitation and came back to Kyoto in 1953.

The Research Institute for Fundamental Physics has many functions in addition to the research activity of its staff. It invites research scholars from all over Japan for short periods to participate in its academic activities. Further, it holds symposia and seminars periodically on topics concerning the theory of elementary particles and the theory of properties of matter, such as nonlocal field theory, meson-nucleon scattering, current topics in statistical mechanics and so forth. There are also facilities for the temporary visitors who come to this Institute to participate in discussions of specific topics in theoretical physics.

As one of its activities the Institute also publishes, with the cooperation of the Physical Society of Japan, the monthly journal, *Progress of Theoretical Physics*. This journal was first founded by Dr. Yukawa in 1946 in order to publish important results which had been obtained in the period during the war and after the war and yet had remained unpublished because of the financial difficulties of the Physical Society of Japan. In addition to this, the Institute also finances the publication of the circular *Soryushiron Kenkyu* and other mimeographs of discussions and lectures in order to inform scholars of the latest developments in theoretical physics.

The Institute is growing more and more to be the national school of learning in theoretical physics. But it is young and has still to grow. Its staff is small, consisting of only four professors and a few research scholars. Also, its funds are limited. It is the aim of the Managing Committee and other friends of the Institute to extend its activities beyond Japan. In fact, it has done so by its sponsoring of the International Seminar on Theoretical Physics in the fall of 1953. It is hoped that with improving economic conditions in Japan, its membership will be extended to other countries and that the Institute will function not only as a national school of learning for Japan, but as an international school of scientific research.

Books

Principles of Numerical Analysis. By Alston S. Householder. 274 pp. McGraw-Hill Book Company, Inc., New York, 1953. $6.00. *Reviewed by P. M. Morse, Massachusetts Institute of Technology.*

Physicists, mathematicians and engineers are now in the throes of learning when a modern high-speed computing machine is useful and when it is not. It used to be that when we had to compute numerical answers we assembled a few tables, a slide rule, perhaps a desk computer and lots of paper and pencils and did our own work, adapting our computing methods, as we went along, to the specific requirements of the work; perhaps changing these methods as the answers came out. Now, if the work threatens to be laborious, we are tempted to ask a "giant brain" to do the job. We then find we have let ourselves in for a lot of work, though of a different kind.

The trouble is, of course, that these giant brains aren't brains; we have to do the thinking for them—*all* of it. We have to foresee *all* the pitfalls in advance and provide for them. All the steps have to be spelled out in detail, all the alternatives, which we used to work out when we came to them, have to be thought through before starting. In some cases this amounts to more work than the old-fashioned way; in many cases though, the results are well worth the effort; computations now can be tackled which were impossibly laborious by the earlier methods. But most of us still are in the process of learning how to use these "labor-savers" and no one can yet be quite sure how much labor he is going to save when he enlists their aid. Which, perhaps, makes it all the more interesting.

But one thing is certain: a good knowledge of numerical analysis is needed before one can hope to get the most out of a high-speed computer. Using a desk computer, one could expect to vary the computing means as the work progressed, according to the needs of the moment. But, now that the planning must all be done in advance, we must know which of the various approximation methods is best for the case at hand and must be able to estimate the final error in the result. This book of Householder is designed to give one the background knowledge needed for the task of planning for a digital machine.

The digital machine reduces all calculus problems to ones of finite differences, all analysis to algebra. Consequently, the subjects dealt with here include the solution of linear equations, the determination of the roots of non-linear equations, the eigenvalue problems related to a matrix, the problems of interpolation and the relationship between differentials and finite differences. There are chapters on each of these subjects and, in addition, there are good progress reports on two subjects, the analysis of computing errors and the Monte-Carlo method, which are rapidly expanding to meet machine programming needs.

This is the first book on numerical analysis to be written specifically for application to high-speed digital computation. It is written in the style of a textbook, with theorems and proofs, rather than as a manual of procedures. The modern fashion of terseness which is adopted makes it slow going, at times, for the novice; this reviewer feels that more general discussions and examples would have made the book more readable. Nevertheless the book will be a most valuable aid to those who are learning how to use high-speed computers.

The Collected Papers of Peter J. W. Debye. 700 pp. Interscience Publishers, Inc., New York, 1954. $9.50. *Reviewed by R. B. Lindsay, Brown University.*

This volume containing in English translation some fifty of the scientific papers of one of the world's great chemical physicists was timed to appear in honor of the 70th birthday of the author on March 24, 1954. The selection was made by Debye himself and reflects his view of the relative significance of his contributions to the fields with which his name will forever be associated, namely: x-ray scattering, dipole moments, electrolytes, and light scattering. A miscellaneous section contains the celebrated paper on specific heats, as well as articles on the scattering of light by ultrasound. The scientific status of each group of papers is summarized briefly in a short introductory article by a well-known authority. The translations are in general commendably clear and straightforward, though there are a few trivial errors which should not trouble the serious reader.

The promoters of this enterprise deserve great credit for making these fundamental papers available to a wider audience. Students of physics should receive more encouragement than they do from their teachers to turn aside occasionally from the standard textbooks to delve into the writings of the authorities on which the textbooks are based. This is particularly true in the case of a master of exposition like Debye, whose articles not only show the keen imagination of a genius at work, but are moreover characterized by careful organization and somewhat unusual lucidity. Here the young student, eager to find out how research in theoretical physics is prosecuted, will find not merely the bare bones of analysis but the physical intuition, the whys and wherefores, as well.

It is unnecessary to stress the versatility which these papers illustrate, ranging as they do all the way from mathematics, in which the author made such a fundamental discovery as the application of method of steepest descents, through classical physics to modern quantum chemistry. In every field studied one senses the uncanny ability to size up the problem from an appropriate physical point of view and to derive a practical physical result with the use of the simplest analysis.

An interesting, though all too brief, biographical sketch of Debye by Raymond M. Fuoss prefaces the collection.

Though the method of production (adopted doubtless for reasons of economy) is satisfactory for the ordinary text material, it scarcely does full justice to the graphs and mathematical equations, which are in many instances a trial to the eyes. This appears to be the only drawback to an otherwise fine production.

The Theory of Metals (Revised second edition). By A. H. Wilson. 346 pp. Cambridge University Press, New York, 1953. $8.50. *Reviewed by R. Smoluchowski, Carnegie Institute of Technology.*

Since the time of its first publication in 1936, Wilson's "Theory of Metals" has become such a well known and useful book that its new, second, edition is bound to meet with greatest interest. The well known characteristics of the book's first edition are still here: mathematical elegance and attention to detail in treatment of basic fundamentals together with rather short or even complete absence of descriptions of less developed or controversial subjects. Just as in the first edition, the accent is on the behavior of electrons in a perfect lattice of a pure monovalent metal, electric conductivity, thermal and magnetic properties and metallic structures. As the author points out in the new preface many theories which looked hopeful in 1936 ran up against serious troubles in comparison with later more quantitative experiments or in application to more complex problems. This necessitated various changes with the result that as compared with the first edition certain sections became considerably enlarged and others are entirely omitted. In the latter category are the early chapters on phenomena dealing with surfaces (rectification in semiconducting contacts, photoelectric effect, etc.), superconductivity, and optical properties. This rather radical surgery is to be regretted since the various theories however imperfect they may be, do represent the present boundaries of our understanding of solids and of metals in particular. In fact, the reviewer is inclined to believe that most of the present interest and theoretical activity in the field of metals is focussed on the more speculative and intuitive parts of the modern theory rather than on the all embracing general mathematical formalism. The book is published with great care and typographic neatness.

Physical Meteorology. By John C. Johnson. 393 pp. Technology Press (MIT) and John Wiley and Sons, Inc., New York, 1954. $7.50. *Reviewed by S. F. Singer, University of Maryland.*

The physics of the atmosphere is a subject to which major contributions have come from many other fields of science: astronomy, radio physics, physical chemistry, spectroscopy, etc. Dr. Johnson has succeeded admirably in extracting and presenting the results of work which is spread throughout a very wide literature. As a consequence we have here a book which deals in a refreshingly direct manner with a great number of topics in physics which find application to the atmosphere. Excluded are meteorological phenomena, dealing with atmospheric circulation.

I think this book will appeal very much as a text to any serious student of physical meteorology. The presentation is fairly elementary, interesting, well-illustrated and sufficiently complete. Each chapter is followed by problems, by selected and up-to-date literature references, and by a list of source books. The specialist will like the book as a reference volume since he is not likely to be a specialist in all the topics presented here. These include: a general treatment of the physics of refraction and scattering of electromagnetic waves in the atmosphere and by small bodies; a specialization to radar waves and visible radiation; applications to atmospheric visibility, radar meteorology, rainbows, to mention just a few. Radiation processes in the atmosphere; heat budget, cloud physics and applications to artificial precipitation. A brief review of properties of the upper atmosphere, ionosphere, and ozonosphere. A fairly detailed discussion of atmospheric electricity.

As can be seen from this brief list the topics range from the mathematical theory of diffraction to discussions of aircraft icing. However the emphasis is one which will appeal to physicists.

Radio Receiver Design. Part I, Radio Frequency Amplification and Detection (Second Revised Edition). By K. R. Sturley. 667 pp. John Wiley and Sons, Inc., New York, 1954. $10.00. *Reviewed by W. T. Wintringham, Bell Telephone Laboratories.*

The reviews in the engineering periodicals of *Radio Receiver Design*, Part I, following its publication in 1943, suggested that this would be a useful text both for practicing radio engineers and in the classroom. Its appearance in a second edition indicates that such optimism was justified. This book has been revised by adding certain new material and by rewriting whole chapters.

Radio Receiver Design, Part I treats antennas and receiver circuitry as far through receivers as the detector. Audio frequency amplifiers, power supplies, receiver measurements, and the design of television and frequency modulation receivers are covered in Part II. While there is no explicit statement of the fact, the author's treatment is directed solely to receivers for use in the broadcasting field. Despite the inclusion of extensive bibliographies in each chapter, there is no indication that the author is aware of the specialized receiver design art found, for example, in the communication industry. Similarly, there is no suggestion that the author is aware of such specialized receiving antennas as the rhombic, which is used in the fixed radio services. However, within its own area this would seem to be a useful text.

In some respects, this reviewer expects that Sturley's style and his treatment of fundamentals would be quite irritating to the theoretical or mathematical radio student. For example, in discussing the modulation of a carrier wave on page 1 of the text, we find "Such a carrier wave possesses two fundamental characteristics, amplitude and time, either of which may be varied by the original signals." The statement that *time* is a characteristic of a signal wave reappears at other points in the text. Along this same line, in Appendix 1A, we find Z equated to the absolute value of the impedance of a circuit in equation 1A.2 and the same symbol equated to the complex impedance in equation 1A.3. Since the purpose of this appendix is to explain complex qualities to the reader, this lack of care in terminology is inexcusable.

One might point out examples in Sturley's text of dogmatic statements which have been refuted by developments in communication art since the time that his manuscript was completed. Also, there are certain inconsistencies. For example, on page 23 it is pointed out that a balanced detector forms a useful part of a frequency modulation receiver. In discussing detection on page 614, however, we find that "It has been shown that only under special circumstances can full-wave detection prove superior to half-wave detection, and the latter is almost universally employed in receivers."

Even though these lapses by the author will prove galling to the purist, they are not so important as to reduce greatly the value of the book to the general student. And, one would expect to find *Radio Receiver Design*, Part I on the practicing radio engineer's bookshelf alongside its American counterpart by Terman.

Mathematics in Western Culture. By Morris Kline. 484 pp. Oxford University Press, New York, 1953. $7.50. *Reviewed by C. Süsskind, Stanford University.*

This is the latest member of the excellent Oxford Mathematics Books series, which also contains the Courant-Robbins *What Is Mathematics?* and Kramer's *The Main Stream of Mathematics*. Professor Kline has set himself the imposing goal of showing that mathematics constitutes a major cultural force in Western civilization; his book is a cogent argument in support of this thesis.

The role of mathematics (and indeed of all science) in the evolution of our civilization has been expounded at length before, most frequently with reference to technological development. In the present volume, the author has undertaken nothing less than to trace the influence of the "queen of the sciences" on such diverse disciplines as philosophy, religion, sociology, literature, music, and the visual arts. To find a scientist who is perfectly at home in all of these fields is in itself quite startling in this day and age, but it is positively amazing to find one who is also a good enough writer to perform the literary *tour de force* of presenting the argument in a manner that will satisfy and fascinate both the layman reader and the scientist.

One of the main reasons why the narrative manages to hold our attention is that it proceeds with many a refreshing change of pace—now an exciting biographical account, now a leisurely philosophic discourse.

In addition to being a connoisseur of the arts (the chapter on Painting and Perspective, which is the only one illustrated by plates, is among the most convincing), Morris Kline is obviously a well-read man. His penchant for eighteenth-century poetry serves him particularly well: the section that discusses the effect of Newton's work on literature and aesthetics is at once witty and erudite.

The material is presented in chronological sequence. As we reach the more recent developments, such as the contributions of Cantor, Lobachevski, Bolyai, Riemann, and Einstein, we find that we are concentrating more and more on the description of the new theories and less on their implications. When he comes to quantum mechanics, the author wisely declines even to explain the subject itself (much less its influence), and regretfully passes on—to a brilliant final chapter in which mathematics is discussed for its own sake, as an important part of our culture.

Mathematics in Western Culture represents an important addition to the book shelf of any scientist who has been touched by the growing awareness of the impact that his work is having on the modern world.

Physics Literature. A Reference Manual. By Robert H. Whitford. 228 pp. The Scarecrow Press, Washington, D. C., 1954. $5.00. *Reviewed by R. A. Beth, Western Reserve University.*

From the preface: "This is a survey of physics literature at the college level. It describes the many types and forms available, selects a representative working collection, and outlines efficient library methods. . . . Background materials have been interspersed for greater interest and information." The arrangement of this guide, by the technology-physics-chemistry librarian of The City College in New York, is novel; it is based on the "approach" (bibliographical, historical, biographical, experimental, mathematical, educational, terminological, or topical) that an information seeker may have in mind. While useful to the research worker, the book should be of particular value to the teacher and student of physics, the graduate student and his advisers, and those who do not have access to expert library guidance.

Climatic Change. Evidence, Causes, and Effects. Edited by Harlow Shapley. 318 pp. Harvard University Press, Cambridge, Massachusetts, 1953. $6.00. *Reviewed by Arthur Beiser, New York University.*

In an effort to elucidate the powerful but unknown forces responsible for the great ice ages, the American Academy of Arts and Sciences held a conference in 1952 at which a number of astronomers, geologists, meteorologists, paleontologists, paleoanthropologists, and still more reconditely learned folk presented their ideas on the general subject of climatic change. The papers given at that meeting have now been collected into a fascinating volume, edited and with an introduction by Harlow Shapley. The pertinent material ranges from fossil pollen found in bogs to the orbit of Pluto, and much of it is written with the nonspecialist (and how many of us are paleodendrologists?) in mind. While there is some agreement on the nature of the major climatic changes of the past, the various suggestions offered here for their origin are sometimes fanciful, often contradictory, and always interesting.

Atomic Physics

Atomphysik, by Herbert Graewe (340 pp. Ferd. Dümmlers Verlag, Bonn, Germany, 1954; DM 19.80), is a compact German text at an intermediate level replete with boxed formulas and tables, carefully worked numerical examples, attractive diagrams and illustrations, quantitative graphs, many references to original papers and more advanced treatments, and a good 19-page subject index. The book's fourteen chapters are grouped in three main parts. The first, on basic principles of atomic physics, contains about a hundred pages on the molecular structure of matter, molecular forces and distances, the periodic system of the elements, elementary particles, mass-energy equivalence, wave-particle duality, and the creation and annihilation of matter. The second part, of fifty-odd pages, treats atomic structure, optical and x-ray line spectra, and the electron shell structure of atoms. The remaining half of the book comprises the third part, devoted to the atomic nucleus: methods of detecting and accelerating charged particles, natural and artificial radioactivity, nuclear structure, reactions and transformations, and atomic energy. There are no problems or exercises for the student such as one would probably find in an American text at this level. Nevertheless, the author has ably fulfilled his aim of providing a clear concise exposition of atomic physics for students, for secondary school teachers, and for interested workers in neighboring fields: chemists, medical men and engineers.

Radio Noise Report

In the eight years that have passed since the discovery of discrete extraterrestrial sources of radio frequency noise a quite considerable amount of work has been done in this field. The first source to be identified lay in the constellation Cygnus; since then over one hundred sources have been distinguished. In an effort to summarize the present state of our knowledge about extraterrestrial rf radiation, a committee composed of J. G. Bolton, F. G. Smith, R. Hanbury-Brown, and B. Y. Mills was chosen by the International Scientific Radio Union (URSI) to prepare a report, Special Report N° 3, on *Discrete Sources of Extra-Terrestrial Radio Noise*. This report has now been published with the aid of Unesco and is available from the General Secretariat of URSI, 42 rue des Minimes, Brussels, Belgium, for $1.50.

Books Received

INTRODUCTION TO OPTICS. GEOMETRICAL AND PHYSICAL (Fourth edition). By John K. Robertson. 416 pp. D. Van Nostrand Company, Inc., New York, 1954. $6.00.

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GAS DYNAMICS OF THIN BODIES. By F. I. Frankl and E. A. Karpovich. Translated from Russian by M. D. Friedman. 175 pp. Interscience Publishers, Inc., New York, 1954. $5.75.

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EINFÜHRUNG IN DIE THEORETISCHE PHYSIK. Part I Mechanik. By Werner Döring. 119 pp. Walter de Gruyter & Co., Berlin, Germany, 1954. Paperbound DM 2.40.

INTRODUCTION TO ATOMIC PHYSICS (Second revised edition). By Otto Oldenberg. 421 pp. McGraw-Hill Book Company, Inc., New York, 1954. $6.00.

DER ULTRASCHALL UND SEINE ANWENDUNG IN WISSENSCHAFT UND TECHNIK (Sixth revised edition). By Ludwig Bergmann. 1114 pp. S. Hirzel Verlag, Stuttgart, Germany, 1954. DM 72.—.

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THE GEOMETRY OF RENÉ DESCARTES (With a Facsimile of the First Edition 1637). Translated by David Eugene Smith and Marcia L. Latham. 243 pp. Dover Publications, Inc., New York, 1954. Paperbound $1.50; clothbound $2.95.

ON THE SENSATIONS OF TONE AS A PHYSIOLOGICAL BASIS FOR THE THEORY OF MUSIC (Second English edition, revised). By Hermann L. F. Helmholtz. 576 pp. Dover Publications, Inc., New York, 1954. $4.95.

ELECTROACOUSTICS. THE ANALYSIS OF TRANSDUCTION, AND ITS HISTORICAL BACKGROUND. By Frederick V. Hunt. 260 pp. Harvard University Press, Cambridge, Massachusetts and John Wiley & Sons, Inc., New York, 1954. $6.00.

LE MAGNÉTISME DES CORPS CÉLESTES. By A. Dauvillier. Book I, Magnétisme Solaire et Stellaire Couronne Solaire et Lumière Zodiacale, 171 pp.; Book II, Variations et Origine du Géomagnétisme, 161 pp. Hermann & C^{ie}, Paris, France, 1954. Paperbound 1600 francs and 1500 francs.

NUCLEAR REACTORS FOR INDUSTRY AND UNIVERSITIES. Edited by Ernest H. Wakefield. 93 pp. Instruments Publishing Co., Pittsburgh, Pennsylvania, 1954. $2.00.

TELEVISION. THE ELECTRONICS OF IMAGE TRANSMISSION IN COLOR AND MONOCHROME (Second revised edition). By V. K. Zworykin and G. A. Morton. 1037 pp. John Wiley & Sons, Inc., New York, 1954. $17.50.

PERCEPTUALISTIC THEORY OF KNOWLEDGE. By Peter Fireman. 50 pp. Philosophical Library, Inc., New York, 1954. $2.75.

GOVERNMENT AND SCIENCE: THEIR DYNAMIC RELATION IN AMERICAN DEMOCRACY. By Don K. Price. 203 pp. New York University Press, New York, 1954. $3.75.

Miscellany

French Science Ministry

A broad plan for consolidating programs of the various French research establishments has been announced by M. Henri Longchambon, who was appointed to the newly created post of Secretary of State for Scientific Research and Technical Progress following the election of M. Mendes-France as Prime Minister of France. Among other contemplated changes in the organization of government research, the following projects are already included in the 1955 budget: establishment of an institute at the Sorbonne equipped with a 100 Mev synchrocyclotron, 2 Mev accelerator, and isotope separator; expansion of the center for nuclear physics at Strasbourg, which will have a 6 Mev accelerator; extension of the Lyons atomic physics institute, which will also have a new accelerator; a nuclear physics center at Grenoble equipped with "an accelerator of a wholly French design"; a 2 billion volt accelerator to be constructed at Saclay by the French Atomic Energy Commission; and a new betatron at the laboratory of atomic synthesis at Ivry, a 2 Mev accelerator at the Ecole Normale Superieure, and a new laboratory and 500 Mev synchrocyclotron at Orsay. The new ministry under M. Longchambon, it is announced, includes a planning and policy council which will aid in coordinating the scientific efforts of the French government.

Industrial Research

The Department of Labor has announced the launching of a nation-wide survey of industrial research and development in the United States. The study, which is being carried out by the Bureau of Labor Statistics for the National Science Foundation, will provide data on research spending and manpower in every major industry. Coordinated surveys of research activities in government agencies, colleges and universities, trade associations, commercial laboratories, and nonprofit institutions will be carried out by the National Science Foundation. The entire survey program is in conformance with the President's Executive Order 10521, which directed the Foundation to make comprehensive studies of research resources and to develop and recommend to him policies to strengthen the nation's scientific research effort.

Industry is in no danger of over-expanding its research, according to E. R. Weidlein, president of the Mellon Institute of Industrial Research, who spoke at a December conference of the American Institute of Management held in New York City. Well-organized industrial research, being "the most effective mechanism ever devised by man to improve his standard of living", is a fruitful source of industrial progress and should be intensified, he indicated. Management officials were warned, however, against destroying the scientific creativity of researchers by attempting to turn scientists into administrators. A more satisfactory approach, he suggested, would be an organizational structure providing for scientific positions equivalent in stature and salary to business administration positions in order to permit scientists to continue working as scientists.

Established

The American Nuclear Society, which was originally called the "Society of Nuclear Scientists and Engineers", came into formal existence last October at a meeting held at the National Academy of Sciences. While primarily interested in nuclear power technology, the Society also includes in its sphere of activity radiation effects, the use of radioisotopes, and similar topics. Membership is open to persons professionally involved in nuclear science and engineering. In one of its first moves the group offered to assist the AEC in implementing the proposed international nuclear energy conference, a subject now under United Nations consideration. ANS will hold its first technical meeting June 27–29 at Pennsylvania State University. Headquarters of the Society are at 329 West 41st Street, New York 36, N. Y.

The Combustion Institute, an incorporated nonprofit, professional society, has been established with executive offices at 200 Alcoa Building, Pittsburgh 19, Pennsylvania. An outgrowth of the Standing Committee on Combustion Symposia, which has sponsored meetings in 1948, 1952, and 1954, the Institute's purpose is to "promote the science and application of combustion and to disseminate knowledge in this field". The Institute has elected a board of directors of fifteen members and the following officers: Bernard Lewis (president), H. C. Hottel (vice president), Stewart Way (treasurer), Bernard M. Sturgis (assistant treasurer), and Glenn C. Williams (secretary). The Institute has also formed a committee with membership drawn from the United States and thirteen other countries which will be responsible for organizing and conducting future combustion symposia.

The Institute of Mathematical Sciences at New York University, representing "an expansion and integration of advanced research and instruction in the mathematical sciences", was formally dedicated on November 29th in ceremonies that included an address on mathematics and natural philosophy by Danish physicist Niels Bohr. Other speakers were Henry T. Heald, chancellor of NYU; George E. Roosevelt, president of the University Council; A. B. Kinzel, director of research for Union Carbide and Carbon Corporation and chairman of the Institute's advisory board; and Richard Courant, director of the Institute. Located in a nine-story building near Washington Square, the Institute operates in three interlocking divisions concerned respectively with mathematics and mechanics, mathematics research (mainly electromagnetic field phenomena), and numerical analysis (including AEC contract work carried on with the UNIVAC computing machine and a research and training program in new computing techniques). The Institute also issues a quarterly journal, *Communications on Pure and Applied Mathematics,* put out by Interscience Publishers, Inc. Future plans call for expansion of the Institute's interest in probability and mathematical statistics and a strengthened program of mathematical physics.

The Boulder Laboratories of the National Bureau of Standards were formally dedicated on September 14, with President Eisenhower doing the honors. The $4 million laboratory, under the over-all direction of Frederick W. Brown, houses two major NBS activities, the Central Radio Propagation Laboratory and the Cryogenic Engineering Laboratory. The CRPL consists of three divisions, devoted to radio propagation physics, radio propagation engineering, and radio standards, directed by Ralph J. Slutz, Kenneth A. Norton, and Harold A. Thomas, respectively. The cryogenics laboratory, sponsored jointly by NBS and the Atomic Energy Commission, is headed by Russell B. Scott and includes liquid hydrogen and nitrogen plants. Two conferences accompanied the dedication of the new NBS facility, one dealing with radio propagation and standards and the other with cryogenics.

Education and Research

The University of Delaware has announced the establishment of a curriculum leading to a doctoral program in physics. The Delaware physics department staff of seven includes specialists in microwave and radiofrequency spectroscopy and in theoretical nuclear physics. The latter field has been strengthened by the addition this year of Sydney Meshkov, who holds a PhD from the University of Pennsylvania, as an assistant professor. The department chairman is William V. Smith.

Formal dedication of the recently established Andre Meyer department of physics at New York City's Mount Sinai Hospital took place November 8th. Paul C. Abersold, director of the AEC's isotopes division at Oak Ridge, was the principal speaker. The department has been active since last spring.

Johns Hopkins University has announced that the recently constructed engineering building, which completes the group of major buildings on the main Quadrangle of the campus, has been named Ames Hall in honor of the late Joseph S. Ames, a noted physicist who served as president at Hopkins for five years prior to his retirement in 1935. He died in 1943 at the age of 78. A former president of the American Physical Society (1919–20), he received his PhD in physics at Hopkins in 1890, joined the faculty the following year, became a full professor in 1899, was director of the physics laboratory for a quarter of a century until his appointment as provost in 1926. He became president in 1929. According to University spokesmen, the astrophysics and electrical engineering departments had already moved into the new Ames Hall by November and it was anticipated that all departments would be completely installed before the first of the year. Formal dedication of the building, which cost $1.5 million, will be held sometime in the spring.

A graduate program of study and fundamental research in plastics has been announced by Princeton University. The curriculum covers the properties, evaluation, production, fabrication, design, and application of materials, and the chemistry of plastics. Contact with industrial plants representing various interests of the plastics industry is included in the program. Fellowships with stipends of from $1500 to $2500 (plus tuition and fees) and research assistantships with stipends of $1500 per academic year are available. For further information write to Louis F. Rahm, Director, Plastics Laboratory, 30 Charlton Street, Princeton, New Jersey.

A research participation program at the Oak Ridge National Laboratory under which university faculty members will conduct research in physics, chemistry, metallurgy, biology, mathematics, and engineering has been announced by the Laboratory and the Oak Ridge Institute of Nuclear Studies. Faculty members may perform their research for periods ranging from three months to a year, with stipends approximating their university salaries. Applications should be submitted six months prior to the proposed time of starting work. Forms and further information may be obtained from the University Relations Division, Oak Ridge Institute for Nuclear Studies, P.O. Box 117, Oak Ridge, Tennessee.

Plans for the International Geophysical Year, scheduled for 1957–58, have already produced a tangible result in the embarkation of a Navy icebreaker on a five-month expedition to the Antarctic for preliminary scientific measurements. Besides making observations in meteorology, cosmic rays, oceanography, radio communication, and glaciology, the personnel of the USS Atka will examine sites for research stations in the Antarctic to be occupied during IGY. It is hoped that information obtained during the expedition will provide a realistic basis for the detailed IGY program in that region.

Publications

A new style guide, *Mathematics in Type,* has been issued for the use of "authors, editors, and others concerned with the preparation and economical production of books and articles containing mathematical expressions". Written "from a printer's viewpoint", the 58-page booklet includes sections on monotype and other methods of composition, mathematical symbols and rules for their setting and spacing, preparation and marking of manuscripts and proof, styling suggestions, and kinds and sizes of type. An introductory section summarizes those characteristics of mathematical material which most often are responsible for difficulty and expense of composition (i.e., variety and nature of symbols, requirements for justification of type, and condition of the original manuscript). *Mathematics in Type* is published by The William Byrd Press, Inc., 1407 Sherwood Avenue, Richmond, Virginia, and is priced at $3 per copy (50% discount to educational institution staff members).

A new quarterly, *The Journal of Nuclear Energy*, is being published by the Pergamon Press of London with J. V. Dunworth, J. Guéron, and G. Randers as editors. The journal is intended to contain papers dealing with the scientific, engineering, biological, and economic aspects of nuclear engineering, and the first issue, which has already appeared, contains articles from the establishments at Harwell (England), Kjeller (Norway), and Saclay (France). Annual subscriptions are 90s., and single issues are 25s.

Another new British journal is *Communications and Electronics,* a monthly publication designed "to show other specialists what telecommunication and electronic systems can do, rather than how they work". One of the early issues demonstrates this thesis by dealing with such diverse subjects as aviation navigational aids, color television, transistors, automatic computers, and safety at sea. The journal is published by Heywood and Co., Ltd., Drury House, Russell Street, London, W. C. 1. The annual subscription is $6.00.

The Atomic Energy Commission, in an effort to help industry judge its interest in technological developments in the atomic energy program, has issued a series of unclassified background bibliographies of selected AEC reports. Titles and abstracts of some 800 unclassified research and development reports were chosen from the nearly 9000 unclassified AEC reports released prior to July 1953 and have been grouped in convenient categories. The entire set can be purchased (cost: $2.25) from the Office of Technical Services, Department of Commerce, Washington 25, D. C., or the following individual sections can be ordered separately: Part I, *Metallurgy and Ceramics* (35¢); Part 2, *Chemistry and Chemical Engineering* (45¢); Part 3, *Nuclear Technology* (35¢); Part 4, *Electronics and Electrical Engineering* (35¢); Part 5, *Mechanics and Mechanical Engineering* (25¢); Parts 6 and 7, *Construction and Civil Engineering* and *Mining and Geology* (25¢); and Parts 8 and 9, *Industrial Management* and *Health and Safety* (25¢). Current unclassified reports likely to be of interest to industry are now listed in a series of separate AEC releases entitled "Nuclear Notes for Industry" rather than being included in *Nuclear Science Abstracts* as was formerly the case. Organizations wishing to receive these current listings should write to the Industrial Information Branch, U. S. Atomic Energy Commission, Washington 25, D. C.

We hear that . . .

Harry C. Allen, Jr., formerly an assistant professor of physics at Michigan State College, has been appointed to the radiometry section of the National Bureau of Standards.

Recent additions to the staff of the guided missile division of Ramo-Wooldridge Corporation, Los Angeles electronic research and development firm, include **Millard V. Barton**, formerly of the University of Texas; **Milton U. Clauser** of Purdue University; **Herbert C. Corben** from Carnegie Institute of Technology; **Louis G. Dunn**, previously director of the California Institute of Technology Jet Propulsion Laboratory; **James C. Fletcher** from Hughes Aircraft Company; **George M. Ewing**, University of Missouri; **Wendell A. Hornig** from General Electric, Hanford, Washington; and **Frank W. Lehan** and **Bernard Rasof** from the Caltech Jet Propulsion Laboratory. **Simon Ramo**, executive vice president of the company, is director of the division. He is assisted by **R. P. Johnson**, vice president for research and development, formerly of Hughes Aircraft Company.

Ralph D. Bennett, senior scientist and technical director at the Naval Ordnance Laboratory in Silver Spring, has resigned after fourteen years of service with the Navy in order to accept a position as manager of the technical department of the GE-operated Knolls Atomic Power Laboratory in Schenectady. Ordered to active duty in 1940 as a lieutenant-commander, Dr. Bennett was instrumental in building NOL from a small laboratory staffed by a dozen scientists into a major national laboratory with a staff of 1000 scientists and engineers and an equal number of technicians. As a captain, USNR, he became technical director in 1944. Following his release to inactive duty in 1947, Dr. Bennett continued with NOL as a civilian scientist.

Joseph Callaway, David Cohen, Behram Kursunoglu, and **Roger Woods** are new members of the physics department at the University of Miami.

Bille C. Carlson of Princeton University has accepted an appointment as associate physicist with the Iowa State College Institute for Atomic Research. The Institute has also announced the appointment of **Charles L. Hammer** as postdoctoral associate.

New members of the staff at Brookhaven National Laboratory are **William Chinowsky, Lauren Doyle, George J. Igo, Robert Meyer**, and **Gus T. Zorn**.

Edward P. Clancy is presently on leave of absence from Mt. Holyoke College where he is associate professor and chairman of the physics department; appointed a research associate, he will serve on the California Institute of Technology faculty for the current year.

Edward J. Cook, Henry J. Fisher, William G. Johnston, and **Glenn M. Roe** are research associates appointed to the General Electric Research Laboratory in Schenectady.

Elections to the board of directors of the Oak Ridge Institute of Nuclear Studies were held on October 19th. The five members elected are: **George L. Cross**, president of the University of Oklahoma; **Paul M. Gross**, vice president of Duke University; **George T. Harrell**, dean of the School of Medicine at the University of Florida; **Edward Mack, Jr.**, professor and chairman of the department of chemistry at Ohio State University; and **J. Harris Purks**, provost of the University of North Carolina. **George H. Boyd**, dean of the graduate school at the University of Georgia, and **T. W. Bonner**, physics professor at Rice Institute, were elected Council chairman and vice chairman, respectively. Dr. Gross was re-elected president of the Institute and **Clifford K. Beck**, physics professor at North Carolina State College, was re-elected vice president. Retiring members of the Board of Directors are Jesse W. Beams, professor of physics at the University of Virginia, and William V. Houston, president of Rice Institute.

Lawrence R. Hafstad, director of the AEC's division of reactor development since January 1949 when it was first organized, has resigned in order to accept a position as atomic energy consultant for the Chase National Bank of New York.

Malcolm C. Henderson has joined the physics department faculty at the Catholic University of America in Washington, D. C., as a research professor. Dr. Henderson, who has recently served with the Federal Civil Defense Organization, was deputy director of intelligence for the Atomic Energy Commission from 1949 to 1953.

Leonard D. Jaffe, former chief of the metals research branch of the Watertown Arsenal Laboratory in Massachusetts, now heads the materials section of the Jet Propulsion Laboratory at California Institute of Technology.

Walter B. Loewenstein has been appointed an assistant physicist at the Argonne National Laboratory.

Lucien Massé of Weiss Geophysical Corporation in Canada has accepted a position as senior research physicist with Magnolia Petroleum Company in Dallas, Texas.

Brian O'Brien, director of the University of Rochester Institute of Optics since 1938, who has been on leave since February 1953 to serve as vice president in charge of research for the American Optical Company at Southbridge, Massachusetts, has resigned from the Rochester faculty to continue his work with American Optical. He will continue to serve on the advisory committee of the Institute of Optics. Dr. O'Brien is succeeded as director by **Robert E. Hopkins,** professor of optics at Rochester and a member of the faculty since 1945.

Franklin B. Pauls has been appointed assistant professor of physics at the Missouri School of Mines and Metallurgy in Rolla. He was previously employed at Tabor College, Hillsboro, Kansas.

Lawrence Baylor Robinson has resigned his position as chief of the theory section in the radiation division of the Naval Research Laboratory in Washington, D. C., to become assistant professor of physics at Brooklyn College.

James M. Sharp, until recently associated with atomic energy development programs at the Air Force Special Weapons Center in Albuquerque, has been appointed supervisor of special projects for the physics department of Southwest Research Institute. He will be responsible for industrial and military research operations in systems analysis, analog computers, energy conversion methods, and electromechanical development.

Harold E. Smith, former assistant professor of physics at the University of Bridgeport, is now teaching at Pennsylvania Military College in Chester.

Conway W. Snyder, formerly senior physicist at Oak Ridge National Laboratory, has been appointed assistant professor of physics at Florida State University.

Thomas L. Thourson, until recently associated with the International Harvester Company, has joined the staff of the Standard Oil Company's Whiting Research Laboratories in Indiana.

Richard Tredgold, previously an assistant lecturer on physics at the University of Nottingham in England, has joined the University of Maryland's physics department as a research associate. He will serve as leader of the solid state theory research group under Ralph D. Myers, director of the program which is supported by the Air Force Office of Scientific Research, Air Research and Development Command.

Edwin L. Zebroski, former project engineer for the submarine advanced reactor project at General Electric's Knolls Atomic Power Laboratory in Schenectady, has joined the staff of Stanford Research Institute. As manager of the nuclear engineering section, Dr. Zebroski will direct work on materials and systems problems associated with nuclear power plants and on the applications of nuclear techniques and radiation effects to industrial problems.

Meetings

Gaseous Electronics

When a group of people get together to discuss a phenomenon that is potentially as complicated as the discharge of electricity through gases, one might expect to find a whole spectrum of types of activity extending from observations made on the complex phenomenon itself at one end, to studies of the abstracted single events which comprise the phenomenon at the other. Such was certainly true of work presented at the Annual Conference on Gaseous Electronics, the seventh, held this year at New York University, October 14 through 16. Jointly sponsored by New York University's College of Engineering, which is celebrating its centennial this year, and the Division of Electron Physics of the American Physical Society, the conference of 244 registered attendants heard 41 contributed papers and 4 invited papers. Clearly not all of these papers can be mentioned in this brief report.

Representative of the studies of fundamental processes are the work of W. M. Hickam and R. E. Fox on negative ion formation using mono-energetic electrons and the calculations of rotational excitation by slow electrons done by E. Gerjuoy and S. Stein. L. M. Branscomb reported experiments on the photodetachment of electrons from negative hydrogen ions, which confirm within 10% the theory of Chandrasekhar. Other work on so-called individual processes is that of A. W. Ehler, N. Wainfan, W. C. Walker, and G. L. Weissler, who measured the cross sections for absorption of light by atoms, the photoionization cross sections of several gases and photoelectric yields from metals.

Somewhat more complicated than the single-event processes are the swarm or multiple-event processes. D. J. Rose reported on measurements of the first Townsend ionization coefficient in hydrogen, which work appears to resolve a long-standing discrepancy between two earlier investigations. Here also belong the measurements of the diffusion and volume destruction coefficients for the helium atom and the helium diatomic molecule by A. V. Phelps, the studies of the effect of temperature on the lifetime of metastable mercury molecules by C. G. Matland and A. O. McCoubrey, and the diffusion calculations by R. N. Varney.

Even more complicated are the ionization processes involving metastable nitrogen molecules investigated by W. B. Kunkel and A. L. Gardner in the long-lived afterglow in nitrogen containing traces of oxygen. Jumping to the extreme in complication of the phenomena studied, we find the work of R. St. John and J. G. Winans on retrograde motion of an arc cathode spot in a magnetic field, and that of C. G. Smith on the anchored mercury arc spot. Here also we should list the work on metallic flames excited by active nitrogen and on afterglows in mixtures of rare gases and nitrogen discussed and beautifully demonstrated by C. Kenty. Employing a high-current arc, the work reported by W. Finkelnburg is directed as much at the use of the arc as a high-temperature laboratory as at understanding its formation.

Much of the work discussed at the conference occupies the middle ground in which one attempts to measure some quantity characteristic of an operating discharge or to study some aspect of an operating discharge. In the first of these categories should perhaps be placed the measurements of electric field in the cathode fall region of a glow discharge by R. W. Warren. In the second category we find a number of papers dealing with breakdown, that is, the build-up of processes which, on application of electrode voltages, lead ultimately to the self-sustaining discharge. Here also belong the papers on plasmas. Experimental evidence for the Townsend avalanche build-up of current preceding the spark breakdown was presented in a paper by H. W. Bandel, who measured currents during the formative time lag in air at atmospheric pressure, and in work by M. Menes in argon. An interesting part of the discussion of breakdown consisted of a symposium of three invited papers presented by F. Llewellyn Jones, L. H. Fisher, and L. B. Loeb. Summarizing the present state of affairs in a complex and controversial field, these papers helped to clarify terminology and indicated general agreement on the importance of the avalanche build-up of current and the role of secondary processes in the pre-breakdown regime, but pointed up the difficulty in explaining the transition from this regime into the characteristic narrow visible channel of the spark at pressures near atmospheric. The paper of H. Margenau, also invited, presented a theory of spectral line widths starting from the quantum mechanical formalism.

Two papers by W. S. Boyle, P. Kisliuk, and L. H. Germer discussed theory and experiment concerning the departure from Paschen's law at very small electrode separations, showing that the departure is caused by enhancement of field emission by the space charge of positive ions formed in metal vapor evaporated from the electrodes. I. A. MacLennan and A. D. MacDonald presented a theory concerning the effect of electron mean free path on the high-frequency breakdown field in neon-argon mixtures. E. L. Huber, in a paper read by Professor Loeb, reported the extension to nitrogen, oxygen, and mixtures of these gases of studies of the corona mechanisms triggered by alpha-particle ionization.

Among the papers discussing the plasma was a theory by E. O. Johnson involving a new model of the low-voltage arc, and a theory of the positive ion saturation region of a plasma probe by G. J. Schulz and S. C. Brown, in which modifications were made to include the drift current of positive ions at the sheath edge. The high-frequency impedance of a plasma was discussed by K. S. W. Champion and S. C. Brown.

A cocktail party and banquet were enjoyed by a large company on Friday evening. Guest speakers were T. E. Allibone of Associated Electrical Industries in England, who discussed work in gaseous electronics being done in England, and W. Finkelnburg of Siemens-Schuckert at Erlangen, who discussed similar work in Germany. The conference committee this year consisted of W. P. Allis, M. A. Biondi, S. Githens, W. R. Gruner, H. D. Hagstrum, E. O. Johnson, and L. H. Fisher, who as secretary, and as the New York University representative, was in large measure responsible for the excellent facilities and smooth working of the conference generally. To the extent that they are available, copies of the book of abstracts of contributed papers at one dollar each may be obtained on request from Professor L. H. Fisher, New York University, New York 53, New York. The conference for next year is to be planned by a committee under the continued chairmanship of W. P. Allis. The committee will also include J. D. Cobine, L. H. Fisher, H. Margenau, A. V. Phelps, and D. J. Rose.

Homer D. Hagstrum
Bell Telephone Laboratories

AAPT Summer Meeting

The 1954 summer meeting of the American Association of Physics Teachers was held on the University of Minnesota campus on June 28–30. In addition to the excellent series of papers, demonstrations, and panel discussions appearing on the program, the association witnessed the total eclipse of the sun, which occurred on the morning of June 30.

The morning meeting on Monday was devoted to the topics of effective demonstrations in physics and to laboratory testing. C. N. Wall, of the University of Minnesota, was chairman. It was pointed out in discussion and demonstrations by F. E. Christenson, St. Olaf College, that showmanship, careful planning, and time provided for students to reflect are essential co-requisites if demonstrations in physics are to be effective. Furthermore, demonstrations should be free from complicated components and should be direct. Use may be made of an oscilloscope, amplifier, or other units without explaining how they work, but stating that the units must be used in showing the demonstration. The materials should be stored so as to be easily available and in units as nearly ready to go as possible.

Haym Kruglak, University of Minnesota, compared performance, essay, and multiple choice tests in laboratory testing. He reported the performance test as the easier, the essay as the harder, and the multiple choice test as the least desirable for laboratory testing.

J. W. Buchta, University of Minnesota, presented a film strip giving the results of a very unique experiment in which he showed that phase velocity is greater than group velocity in a dispersive medium. This film strip may soon become available through one of the scientific apparatus companies. This was followed by the showing of several AAPT classroom films by V. E. Eaton of Wesleyan University.

On Monday afternoon AAPT met jointly with the American Physical Society, APS Vice President R. T. Birge of the University of California presiding. A group of very interesting and timely papers on astronomy and astrophysics was given with each speaker summarizing his field and giving the most recent information pertaining to his subject. The topics and speakers were: "Galactic Magnetic Fields" by W. A. Hiltner, Yerkes Observatory; "White Dwarfs and Degenerate Stars" by W. J. Luyten, University of Minnesota; "The Probable Age of the Earth" by T. L. Collins, University of Minnesota; "Radio Astronomy" by F. Graham Smith, Cambridge University.

Following the very interesting informative evening lecture, by Ed Ney, University of Minnesota, in which he summarized the work in cosmic rays to the present date, the societies attended the department of physics open house. The cosmic-ray, thermal diffusion, mass spectroscopy, biophysics, general physics, and x-ray laboratories were open. The Van de Graaff generator room and the 68 Mev proton linear accelerator building were also visited.

Tuesday morning was given over to ten-minute papers with Frank Verbrugge, Carleton College, presiding. Marsh W. White, president of AAPT, acted as moderator for a round-table discussion on methods of accomplishing the function and mission of AAPT. The objectives of the Association as set out in the constitution were read and studied with the viewpoint of finding means to augment them. Suggestions of methods for encouraging physics students, definite programs for the training of physics teachers, research in the teaching of physics, and cooperative efforts to encourage more high school students to study mathematics and physics were among the ideas discussed. Thomas H. Osgood, AAPT *Journal* editor, set forth the aim of the *Journal* as bringing out articles that have one or more of the following six purposes: educational, informative, pedagogical, reportorial, professional, and inspirational. It was suggested that certain people be invited, through the pages of the *Journal*, to explain how they teach particular areas of physics, also that the Association send literature and invited lecturers to institutions to help acquaint more students with physics and with the opportunities in the field of physics.

R. F. Paton, secretary of AAPT, presiding, introduced the symposium report of the Urbana ASEE Symposium on Physics in Engineering Education. The report was presented by J. G. Potter, A and M College of Texas.

Richard Sutton, Haverford College, presented a very informative and lucid demonstration lecture on "Tomorrow's Total Eclipse" at the dinner meeting on Tuesday evening, Marsh W. White presiding. This was followed by a lecture on "Processing Minnesota Taconite", by E. C. Davis, University of Minnesota.

The early risers on Wednesday morning witnessed the launching of the cosmic ray "Skyhook" balloon by General Mills Corporation. The process of filling the balloon and preparing it for ascension was found by many to be very educational. The sunrise was witnessed by all with enthusiastic anticipation for what was to follow in less than one hour. As 5:08 A.M. approached, the moon moved across the face of the sun. From partial eclipse to Baily's beads, to the brilliant diamond-ring effect, and to totality formed a series of events that all who saw it can never forget. The beautiful pearly-gray pastel coloring of the corona with the coronal streamers stretching millions of miles from each side of the sun's equator and the coronal spikes at the sun's poles were clearly visible in the cloudless sky. A prominence was visible to the unaided eye at the 7 o'clock position during totality. The brilliant diamond-ring effect appeared again as the moon moved away from totality.

The association reconvened at nine o'clock for a round-table discussion on "The Preparation of College Physics Teachers", J. W. Buchta of the University of Minnesota as moderator. Participants on the panel were Russell M. Cooper (University of Minnesota), Thomas H. Osgood (Michigan State College), George Pake (Washington University), and Frank Verbrugge (Carleton College). This was followed by a report of the Northwestern University Conference on the Training of Graduate Student Assistants, presented by C. J. Overbeck, Northwestern University, with J. G. Winans, University of Wisconsin, presiding. The requirements and qualities of a good teacher that were stressed were knowledge of subject, enthusiasm for teaching, adequate time and inclination to accomplish the above, lucidity, and creativity. It was emphasized that the training of a teacher should not differ from the training of a research specialist. It was also pointed out that more concern must be placed upon giving guidance to the graduate assistant in his teaching program.

At the executive committee meeting T. H. Osgood was appointed on the U.S.A. National Committee of the International Union of Pure and Applied Physics. Interest was also shown in a plan to encourage conferences between engineers and physicists on the place of physics in engineering education. The association plans to hold the 1955 summer meeting of AAPT in June at Pennsylvania State University in conjunction with ASEE.

Glenn Q. Lefler
Eastern Illinois State College

IRE Nuclear Science Group

The Institute of Radio Engineers Professional Group on Nuclear Science held its First National Annual Meeting on October 6 and 7 at the Sherman Hotel in Chicago. More than two hundred registrants heard nineteen submitted and invited papers during the two-day meeting.

Highlight of the meeting was an address by L. R. Hafstad, director of reactor development for the AEC,

A.P.S.—A.A.P.T.
MEETING AND EXHIBIT
Jan. 27, 28, 29, 1955 New York City

An exhibit of technical books, instruments, and apparatus is being scheduled for the combined winter meeting of the American Physical Society and the American Association of Physics Teachers. The exhibit will be located in the East and Blue rooms of the Hotel McAlpin, 34th Street and Broadway. These rooms are adjacent to the registration desk located on the first mezzanine of the hotel. The exhibits will be open each day of the meeting, January 27, 28, 29, 1955, and everyone attending the meeting is cordially invited to visit the exhibits.

Publishers and manufacturers interested in exhibiting should write to Mr. T. Vorburger, Exhibit Manager, 57 East 55th Street, New York 22, N. Y.

who discussed the present five-year government program of reactor research. He stated that while in the near future atomic energy will not be the exclusive source of energy, nor will it necessarily make energy cheap, the indications are, however, that atomic power will prevent present costs of energy from rising. The experimental boiling water reactor is one example of a reactor which shows good promise for reducing costs, he said.

Alvin Weinberg of Oak Ridge National Laboratory, in discussing the homogeneous reactor experiment, mentioned the possibility that one result of the experiment might be to put electronic engineers out of the reactor business. Reason—the essential simplicity of the homogeneous type reactor. Some features of the Oak Ridge reactor: the core is contained in an 18-inch stainless steel sphere; 1 gram of U-235 is consumed per day at high-power operation (1000 KW); total activity of the reactor at the 1000 KW level is 30 million curies; 10 million curies of activity in the form of fission gases must be removed per day. The big advantage of this type of reactor is that it is temperature compensating. It is thus a slave to power demands. As power is removed from the reactor system, its fuel temperature drops, resulting in increased reactivity, which in turn increases the power level. Such a reactor is very unlikely to blow itself up, in the event of some sort of accident.

Lyle B. Borst from New York University described an economic "little power" reactor. Since it is specifically designed for use in railroad locomotion, it has vital restrictions as to size in that the reactor cannot be more than 10 feet wide, 16 feet high, or 60 feet long. Since approximately four feet of shielding is needed on each side, the actual reactor width could be only two feet.

Robert Vestergaard described Sweden's first reactor. A heavy water moderated, high-power (100 KW), low-temperature reactor, it is housed in an underground building only two kilometers from the center of the city. Plans to build Sweden's second reactor are now underway.

G. C. Laurence from Atomic Energy of Canada, Ltd., stated that the Canadian government has authorized a large-scale program of atomic development. The present Canadian interest is in large central station reactors—not packaged power plants. Dr. Laurence described the NRX and NRU reactors. The new NRU reactor will be of much higher power than NRX and will be moderated and cooled by heavy water. Dr. Laurence emphasized the value of international symposia of this sort because of the many reactor problems which face everyone in this field.

S. J. Goslovich
Glen Ellyn, Illinois

Spectroscopy Seminar

The University of Florida's 3rd annual spectroscopy symposium, dealing with various applications of emission spectroscopy and open to anyone interested in spectroscopy, will be held February 2–4. All inquiries should be addressed to Professor William T. Tiffin, College of Engineering, University of Florida, Gainesville, Florida.

Industrial Spectroscopy

Industrial Applications of Spectroscopy will be the theme of the 6th Annual Conference of the American Association of Spectrographers, which will take place in Chicago on May 6th. Contributed papers in the fields of emission, x-ray fluorescence, or absorption spectroscopy as applied to industry are invited. Abstracts must be submitted by March 1, 1955. Inquiries should be addressed to F. E. Stedman or E. E. Stilson, Co-Chairmen, Engineering Research Laboratory, Products Division, Bendix Aviation Corporation, 401 North Bendix Drive, South Bend 20, Indiana.

Electromagnetic Wave Theory

An International Symposium on Electromagnetic Wave Theory sponsored by Commission VI of URSI (International Scientific Radio Union) and the University of Michigan will be held June 20–25 at the University of Michigan in Ann Arbor, Michigan. The work of the symposium will be separated into the following specific major topics: (1) propagation in doubly refracting media in wave guides (e.g. ferrites); (2) boundary value problems of diffraction and scattering theory; (3) work in antenna theory of fundamental importance; (4) forward scattering; and (5) multiple scattering of light by colloidal particles. Of particular interest are millimeter wave developments in the above topics. Those who wish to present papers should submit abstracts (not more than 200 words) by March 31, 1955, to K. M. Siegel, Chairman, Symposium on Electromagnetic Wave Theory, Willow Run Research Center, University of Michigan, Ypsilanti, Michigan. Further information on the symposium can be obtained by writing to J. W. Crispin, Jr., at the same address. Housing accommodations are necessarily limited in a college community; as a result registration and room reservations will be allotted in order of receipt.

NSF Travel Grants

A limited number of grants to physicists in support of travel to international meetings will be made during 1955 by the National Science Foundation. Application blanks are available from the Foundation, Washington 25, D. C., and should be received by January 24th. Meetings for which travel requests will be considered are: (1) Elementary Particle Conference, Pisa, Italy, April; (2) Gas Discharge Physics, Delft, Holland; (3) International Congress on Cosmic Radiation, Mexico City, Mexico, September 10–15; and (4) Symposium on the Solid State and Plasticity, International Union of Theoretical and Applied Mechanics, Madrid, Spain, September 26–28.

Calendar of events

Material for inclusion in the calendar and meeting sections should be received 6 weeks prior to the date of the issue in which it is to appear. Further information about these meetings can be obtained by writing to the addresses indicated in parentheses.

January

10–14 Society of Automotive Engineers, 50th anniversary mtg, Hotels Sheraton-Cadillac and Statler, Detroit, Mich. (*SAE, 29 W. 39 St., New York 18, N. Y.*)

11 **Optical Society of America, Rochester Section,** Rochester Museum of Arts and Sciences (*D. S. Cary, Eastman Kodak Co., Rochester 4, N. Y.*)

12 Milwaukee Society for Applied Spectroscopy, Marquette U. (P. W. Kehres, A. O. Smith Corp., Milwaukee 1, Wis.)

13 **Cleveland Physics Society,** Case Inst. of Technology, Cleveland (*J. C. Bowman, National Carbon Research Laboratories, P. O. Box 6087, Cleveland, Ohio*)

17–19 High-Frequency Measurements, conf. sponsored by IRE, AIEE, URSI, NBS, Washington, D. C. (*F. J. Gaffney, Fairchild Guided Missiles Div., Wyandanck, L. I., N. Y.*)

18 Society for Applied Spectroscopy, Philadelphia Section (*G. L. Crumrine, North American Smelting Co., Marine Terminal, Wilmington, Del.*)

18 Society of Photographic Engineers, New York Chapter (*I. R. Kohlman, Pavelle Color Inc., 533 W. 57 St., New York 19, N. Y.*)

24–28 Institute of the Aeronautical Sciences, annual mtg., Hotel Astor, New York City (*IAS, 2 E. 64 St., New York 21, N. Y.*)

25 **Optical Society of America, Rochester Section,** Rochester Museum of Arts and Sciences (*D. S. Cary, Eastman Kodak Co., Rochester 4, N. Y.*)

26–2 Australian and New Zealand Association for the Advancement of Science, Melbourne (*J. R. A. McMillan, 157 Gloucester St., Sydney, Australia*)

27–29 **American Physical Society,** Hotels New Yorker and McAlpin, New York City (*K. K. Darrow, Columbia Univ., New York 27, N. Y.*)

27–29 **American Association of Physics Teachers,** annual mtg., Hotel McAlpin, New York City (*R. F. Paton, U. of Illinois, Urbana, Ill.*)

February

1 Society for Applied Spectroscopy (*C. A. Jedlicka, U. S. Testing Co., 1415 Park Ave., Hoboken, N. J.*)

8 **Optical Society of America, Rochester Section,** Rochester Museum of Arts and Sciences (*D. S. Cary, Eastman Kodak Co., Rochester 4, N. Y.*)

9 Milwaukee Society for Applied Spectroscopy (*P. W. Kehres, A. O. Smith Corp., Milwaukee 1, Wis.*)

10 **Cleveland Physics Society,** Case Inst. of Technology, Cleveland (*J. C. Bowman, National Carbon Research Laboratories, P. O. Box 6087, Cleveland 1, Ohio*)

17–18 Transistor Circuits, conf. sponsored by U. of Penna., IRE and AIEE, U. of Pennsylvania, Philadelphia (*Inst. of Radio Engineers, 1 E. 79 St., New York 21, N. Y.*)

19 **American Association of Physics Teachers, Oregon Section,** Portland State College (*D. Bolinger, Oregon State College, Corvallis, Ore.*)

23 Instrument Society of America, N. Y. Section, conf. on instrumentation for data reduction and presentation, Hotel Statler, New York City (*H. Bristol, 250 W. 57 St., New York, N. Y.*)

28–4 6th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, William Penn Hotel, Pittsburgh (*J. F. Miller, Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.*)

March

1–3 Joint Western Computer Conference and Exhibit, Statler Hotel, Los Angeles (*W. Gunning, International Telemetering Corp., 2000 Stoner Ave., Los Angeles 25, Calif.*)

17–19 **American Physical Society,** Lord Baltimore Hotel, Baltimore, Md. (*K. K. Darrow, Columbia Univ., New York 27, N. Y.*)

21–25 **American Society for Metals,** Los Angeles, Calif. (*W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio*)

31–1 Symposium on Boundary Layer Effects in Aerodynamics, Teddington (*Director, National Physical Laboratory, Teddington, Middlesex, England*)

April

1–2 **American Association of Physics Teachers, Pennsylvania Section,** Wilson College, Chambersburg (*Dorothy W. Weeks, Wilson College, Chambersburg, Pa.*)

7–9 **American Physical Society, Southeastern Section,** U. of Florida, Gainesville, Fla. (*D. Callihan, Box 247, Oak Ridge, Tenn.*)

7–9 **Optical Society of America,** Hotel Statler, New York City (*A. C. Hardy, Massachusetts Inst. of Technology, Cambridge 39, Mass.*)

8–9 **American Physical Society, Ohio Section,** Wesleyan Univ., Delaware (*L. E. Smith, Denison Univ., Granville, Ohio*)

14 World Meteorological Organization, Congress, Geneva (*G. Swoboda, 1 avenue de la Paix, Geneva, Switzerland*)

16 **American Association of Physics Teachers, Chesapeake Section,** Morgan State College, Baltimore (*J. R. Heverly, 7100 Connecticut Ave., Chevy Chase, Md.*)

21–23 Inter-American Congress of Radiology, Washington, D. C. (*J. A. del Regato, The American College of Radiology, 2200 Cascade Ave., Colorado Springs, Colo.*)

25–27 National Academy of Sciences, annual mtg., Washington, D. C. (*A. Wetmore, NAS, 2101 Constitution Ave., Washington 25, D. C.*)

28–30 **American Physical Society,** NBS, Hotels Sheraton-Park and Shoreham, Washington, D. C. (*K. K. Darrow, Columbia Univ., New York 27, N.Y.*)

May

2–5 Semiconductor Symposium, Cincinnati, Ohio (*F. J. Biondi, Bell Telephone Laboratories, Murray Hill, N. J.*)

16–20 Conf. on Weights and Measures, annual, Washington, D. C. (*W. S. Bussey, National Bureau of Standards, Washington 25, D. C.*)

June

8–24 **American Society for Metals** and Joint Metallurgical Societies mtg., London, England, Düsseldorf, Germany, and Paris, France (*W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio*)

13–17 Symposium on Molecular Structure and Spectroscopy, Ohio State Univ., Columbus (*H. H. Nielsen, Ohio State Univ., Columbus 10, Ohio*)

13–22 International Commission on Illumination, Zürich, Switzerland (*C. A. Atherton, ICI, Hopkinton, N. H.*)

20–24 **American Association of Physics Teachers,** joint mtg. with American Society for Engineering Education, State College (*M. W. White, Pennsylvania State Univ., State College, Pa.*)

20–25 Electromagnetic Wave Theory, internat'l symposium, sponsored by Commission VI of URSI, U. of Michigan (*J. W. Crispin, Jr., U. of Michigan, Ann Arbor, Mich.*)

21–24 International Aeronautical Conference joint mtg. of the British Aeronautical Society and the Institute of the Aeronautical Sciences, Los Angeles (*IAS, 2 E. 64 St., New York 21, N. Y.*)

22–24 **American Physical Society,** U. of Toronto, Toronto, Canada (*K. K. Darrow, Columbia Univ., New York 27, N. Y.*)

24–2 International Statistical Institute, Rio de Janeiro, Brazil (*ISI, Oostduinlaan, The Hague, Netherland*)

27–29 American Nuclear Society, conf., Pennsylvania State Univ., State College (*U. Liddel, 1104 Fisher Bldg., Detroit, Mich.*)

30–2 **Acoustical Society of America,** State College, Pa. (*W. Waterfall, 57 E. 55 St., New York 22, N. Y.*)

August

31–2 **American Physical Society,** Mexico City, Mexico (*K. K. Darrow, Columbia Univ., New York 27, N. Y.*)

September

10–15 International Congress on Cosmic Radiation, sponsored by the Commission on Cosmic Rays of IUPAP, Mexico (*P. Fleury, 3 boulevard Pasteur, Paris 15, France*)

26–28 Symposium on the Solid State and Plasticity, sponsored by International Union of Theoretical and Applied Mechanics, Madrid, Spain (*H. L. Dryden, 1724 F St., N. W., Washington 25, D. C.*)

PLACEMENT SERVICE REGISTER

OF THE

AMERICAN INSTITUTE OF PHYSICS

to be held in connection with the

American Physical Society Meeting

January 27, 28, 29, 1955
Hotel New Yorker, New York, N. Y.

LOOKING FOR PHYSICISTS?

Universities, institutions, government laboratories, and companies wishing to post notices of positions may send descriptions of the openings on 8½ x 11 paper in multiple copies (*15 required*) to the Institute office, or post them on arrival at the meeting. If you plan to have a representative present, to interview applicants, please indicate his name at the bottom of the job description sheets.

SEEKING A NEW POSITION?

Applicants may obtain registration forms and further information from the Institute office. *Pre-registration is essential.* Complete registration forms must be received at the Institute office by January 10, 1955 to insure their inclusion at this register.

INTERVIEWS.

It is to the advantage of the registrants to be present. Interviews will be arranged between employers' representatives and applicants attending the meeting.

COMPLETE REGISTER of applicants will be available upon request at the meeting and after the meeting at a nominal service charge.

PLEASE REPORT TO THE PLACEMENT OFFICE UPON ARRIVAL AT THE MEETING

AMERICAN INSTITUTE OF PHYSICS, 57 East 55 Street, New York 22, N.Y.